EDISON
ELECTRIC INSTITUTE
BULLETIN

GEOGRAPHY,
RESOURCES & INDUSTRIES

NOVEMBER-DECEMBER, 1942

NOV 30 1942

Bi-Monthly or Quarterly Meter Reading and Related Billing Plans
H. B. HARDWICK 393

List of Bi-Monthly and Quarterly Meter Reading Schemes 396

The Cost of Living and Electric Rates . . . . . F. A. NEWTON 398

War Safety in the Public Utility Industry . . . H. O. SPRINKLE 399

Outstanding Scrap Collection Job 402

Substitutions of Material and Changes in Practice to Meet Wartime Conditions . . . . . L. M. SMITH 403

Results of Emergency Overload Tests on 24-Kv, 3-Conductor Paper and Lead Cable . . . . G. B. McCABE and JOSEPH STICHER 405

Protection Against Sabotage . . . . . J. A. SUMMERS 410

Serious Shortages in Manpower for Appliance Maintenance Disturbing to Dealers 413

Lettering on Engineering Drawings . . . . . F. P. KUHL 415

Obituaries 416

Accident Prevention Committee Meeting . . . GEORGE S. DIEHL 418

The Neil Historical Article on the Industry 419

Recent EEI Publications 420

Personals 421

EEI Publications and Service Material 422

Conventions and Meetings, 424

EDISON ELECTRIC INSTITUTE

THE ELECTRIC LIGHT AND POWER INDUSTRY

Current Statistical Data Covering 100 Per Cent of Industry

September, 1942

SOURCE AND DISPOSAL OF ENERGY—MONTH OF SEPTEMBER

	1942	1941	%
GENERATION* (Net)			
By Fuel Burning Plants	10,943,530,000	10,355,800,000	+ 5.7
By Water Power Plants	5,213,552,000	3,997,000,000	+30.4
Total Generation	**16,157,082,000**	**14,352,800,000**	**+12.6**
Add—Net Imports Over International Boundaries		71,226,000	.....
Less—Company Use	**Details Not**	222,315,000	.....
Less—Energy Used by Producer	**Yet**	286,358,000	.....
Net Energy for Distribution	**Available**	**13,915,353,000**	.....
Losses and Unaccounted For		1,769,376,000	.....
Sales to Ultimate Customers	**13,712,277,000**	**12,145,977,000**	**+12.9**

CLASSIFICATION OF SALES

NUMBER OF CUSTOMERS—As of September 30th			
Residential or Domestic	26,565,658	25,736,132	+ 3.2
Rural (Distinct Rural Rates)	1,101,980	974,969	.....
Commercial or Industrial:			
Small Light and Power	4,274,974	4,286,804	− 0.8
Large Light and Power	152,509	174,638	
Other Customers	123,314	118,612	.....
Total Ultimate Customers	**32,218,435(a)**	**31,291,155**	**+ 3.0**
KILOWATTHOUR SALES—During Month of September			
Residential or Domestic	2,156,644,000	2,031,447,000	+ 6.2
Rural (Distinct Rural Rates)	354,717,000	296,612,000	+19.6
Commercial or Industrial:			
Small Light and Power	2,321,721,000	2,119,748,000	+ 4.6**
Large Light and Power	7,734,880,000	6,770,879,000	+16.1**
Street and Highway Lighting	156,562,000	170,374,000	− 8.1
Other Public Authorities	372,900,000	250,567,000	+44.3**
Railways and Railroads:			
Street and Interurban Railways	328,581,000	298,228,000	+10.2
Electrified Steam Railroads	193,935,000	168,459,000	+15.1
Interdepartmental	92,337,000	39,663,000	+132.8
Total to Ultimate Customers	**13,712,277,000**	**12,145,977,000**	**+12.9**
Revenue from Ultimate Customers	**$240,252,700**	**$226,042,500**	**+ 6.3**

(a) Subject to Revision following state by state analysis now under way
(**) Based on changes made in same classifications both years

RESIDENTIAL OR DOMESTIC SERVICE (Revised Series)

AVERAGE CUSTOMER DATA—For the 12 Months Ended September 30th			
Kilowatthours per Customer	1,015	976	+ 4.0
Average Annual Bill	$37.35	$36.70	+ 1.8
Revenue per Kilowatthour	3.68¢	3.76¢	− 2.1

(*) By Courtesy of the Federal Power Commission

SPECIAL NOTICE

This issue of the EDISON ELECTRIC INSTITUTE BULLETIN is dated November-December, 1942, in order that subsequent issues may appear by the first of the month of issue instead of the last week of the month of issue as heretofore. Continuity and frequence of issue is not affected.

Thus the next issue will be dated January, 1943, and will appear the last week in December. Yearly subscriptions will cover twelve issues of the BULLETIN.

Vol. 10, Nos. 11 and 12, EDISON ELECTRIC INSTITUTE BULLETIN; published bi-monthly. Entered as second-class matter Aug. 17, 1933, at the post office at Philadelphia, Pa., under the act of March 3, 1879. Publication office, 56th and Chestnut Sts., Philadelphia, Pa. Editorial office, 420 Lexington Ave., New York, N. Y. Subscription rate $2.00 per year in the United States; $3.00 per year in foreign countries.

The Edison Electric Institute does not assume responsibility for, nor necessarily endorse or approve, statements made by contributors to the BULLETIN.

EDISON ELECTRIC INSTITUTE BULLETIN

Volume 10 NOVEMBER-DECEMBER, 1942 Nos. 11 and 12

Bi-Monthly or Quarterly Meter Reading and Related Billing Plans

To Conserve Rubber, Automotive Equipment and Manpower

By H. B. Hardwick

Assistant Comptroller, The Commonwealth & Southern Corporation, New York City

A paper presented before the Accounting Conference of the Southeastern Electric Exchange, Birmingham, Ala., October 30, 1942

IN order to conserve materials, equipment, and manpower, it is necessary that the use of critical materials and the employment of personnel be reviewed to determine wherein modifications can be made in current practice to accomplish the desired economies. One of the necessary activities of utility companies is the reading of customer meters and the rendering of bills. The subject assigned to me is the matter of economies that can be made in the reading of meters and in the related billing.

During the First World War, because of a shortage in manpower, many of the large electric and gas utility companies were forced to adopt plans of reading meters less frequently than once a month and instituted practices of reading meters and rendering bills every other month. When the war was over and conditions returned to normal, all of the companies, except the Detroit Edison Company, reverted to the practice of reading meters and rendering bills monthly. In my opinion the plan of reading meters and billing customers every two months failed to survive because it did not provide for rendering monthly bills to the customers. A great majority of customers prefer to receive a bill every month, and find it easier to pay a small bill for one month's services than to pay a larger bill for services of two or more months.

Utility companies have always had the problem of billing customers whose meters could not be read by the meter readers on their regular schedule. It has been customary for a skip meter reader to follow the regular meter reader to obtain readings of the meters that were not read by the regular meter reader, or to leave a postcard requesting the customer to furnish the meter readings in case they could not be obtained by the skip meter reader. There were always, however, a number of customers who did not return the post cards and who were not rendered a bill for the current month. Within the last few years a few companies instituted the practice of sending "averaged bills" based on previous use to customers whose meters were not read by the regular meter reader. A sticker was pasted on the bill explaining that the "averaged bill" was sent in order to avoid the necessity of rendering, the following month, a bill for two months' service. About 5 per cent of the customers were billed in this manner, and furnished a good basis for evaluating the merits of the procedure. Very few complaints were received from the customers. The practice saved the companies the expense of sending skip meter readers or post cards to obtain the meter readings that had been skipped, and enabled them to take into the current month's income the revenue from these customers.

It has occurred to a few companies that all residential and commercial customers' meters could be read bi-monthly or quarterly and that "averaged bills" could be rendered for the intervening month. If the plan worked satisfactorily for about 5 per cent of the customers, why not apply it to all customers and reduce the cost of meter reading by one-third or one-half? The plan did not receive general approval of utility executives until the shortage of manpower, automobiles, tires and gasoline became acute. Recently it has been widely discussed among utility executives as a means of contributing to the conservation of critical materials and manpower. The war gave the plan the impetus required to get it started, and the customers have accepted the new billing procedure partly at least because of the public realization of the necessity of conserving materials and labor.

The operating companies in The Commonwealth & Southern System began studying the possibilities of reading customers' meters less frequently than once a month and the rendering of averaged bills to customers based on previous use in the early part of 1941, before the present war conditions made it evident that the companies would be faced with a shortage of men and materials. The plan first considered contemplated the preparation of "averaged bills" for the intervening months, based on a review of the customers' consumption for the same month in the previous year and taking into consideration the increase in use and other changes in the customers' habits that may have taken place during the previous few months. Consideration of this method of billing customers in the intervening months brought out the disturbing fact that it could not be applied uniformly to all customers, and that it would be a difficult method for the customers to understand. It depended too much on the individual judgment of the employees, who computed the customers' bills and this judgment would vary with each individual.

From a public relations standpoint,

therefore, it was considered advisable to adopt a plan that would provide a fixed formula for computing bills in the intervening months—a method that could be easily explained by the employees and readily understood by the customers. The so-called "double or triple block" method of computing bills was developed to overcome the objections to the "judgment" method, and it was decided to find out what effects each method would have on the customers' bills and the revenue of the companies. The two methods of computing bills were applied to a cross section of the customers of each company, based on the number of customers in each rate classification. The results were the same for each company—the "judgment" method reduced the customers' bills and the revenue of the company, whereas the "double or triple block" method slightly increased the customers' bills and the revenue of the company.

The two methods of computing bills may be briefly described as follows:

JUDGMENT METHOD

Based on customers' previous actual use, taking into consideration all the factors which may affect the amount of the bill, including the average use for the past few months, the use for the same month last year, the season of the year, and any known factors, which may affect the individual account. The following month, when the meter is read, the estimated consumption previously billed is deducted from the actual consumption for the two (or three months) and the bill computed on the standard rate chart.

DOUBLE OR TRIPLE BLOCK METHOD

Based on one-half of the sum of the two bills for the previous two months or one-third of the previous three months. The following month, when the meter is read, the consumption for the two (or three) months is computed by doubling (or tripling) the rate blocks in the applicable rates, and deducting therefrom, the estimated amount billed in the intervening month, or months.

•

As a result of the studies with each of the operating companies, we became convinced that customers' meters should be read bi-monthly, and bills computed by the "double block" method because this plan would produce the most satisfactory results. The principal advantages of this plan are that it provides a definite formula, or basis, for computing the customers' bills in the intervening months; there is no guess work and no necessity to make any assumptions; the bills of all customers are computed in a uniform manner; the method is easy to explain to the customers, and it has very little effect on the customers' bills. The disadvantages of the plan are that it requires changes in bill forms, meter reading sheets, billing machines, billing charts, etc., and probably requires more clerical work than would be required under the "judgment" method.

Under this plan, one-half of the customers' meters are read one month and the following month the other half are read. The customers whose meters are not read receive bills showing dollars and cents only, with no meter readings and no consumption figures. The following month the bill will show the consumption for the two months, the amount for the two months computed by doubling the rate blocks, a deduction for the amount billed in the previous month, and the amount of the bill for the current month. In those cases where the paper bill form is used, the previous meter readings and the "service from" date are not shown on the bills; where the postcard bill is used no meter readings are shown. These details have been eliminated from the bills because we regard them as non-essential and because of the limitations of present billing machines and the difficulty of getting new billing machines. Another factor making it necessary to eliminate non-essential data is the limited space on postcard bills. Many companies are now using postcards for customers' bills and, with commission approval, have left off the data on rates.

Five of the operating companies in The Commonwealth and Southern System have adopted the plan of reading meters bi-monthly and computing bills on the "double block" method and have applied it to all electric and gas residential customers, urban, rural, and house heating, and to all commercial customers without demand meters, or to a total of more than 900,000 electric and 200,000 gas customers. Reports received from these companies have been very gratifying. In each case the results have exceeded expectations, the customer reaction has been good and, even though bill forms have been changed, few complaints have been received. The savings have been greater than originally estimated. This plan is being extended to the other companies in The Commonwealth & Southern System.

As far as I have been able to find out, the operating companies in The Commonwealth & Southern System are the only companies that have made the plan effective in both urban and rural areas. All other utility companies, of which I have knowledge, that have adopted either bi-monthly or quarterly meter reading plans have applied them only to their automobile route customers. It is safe to say, therefore, that the experience of The Commonwealth & Southern companies furnishes a good basis for judging the merits of the plan, since there are probably included in the plan more customers than in all other plans combined.

It may be of interest to quote some of the comments received from our general and divisional offices. Here they are:

"We have more than 50,000 residential customers, and several thousand commercial customers billed under the Bi-monthly reading plan. During the past two months each of these customers has received one averaged bill and one reading bill. We have had only five cases where customers stated they could not compute the amount of their bills and required assistance."

"We had 200 high bill complaints caused by estimating the averaged bill too low, which is approximately the same number of high bill complaints we had during a like period prior to adoption of the plan."

"There were some high bill complaints from customers who had been on vacations. Only one was not satisfied after the plan was fully explained."

"A summary of the number of complaints and inquiries during the first three months (in an operation having 90,000 electric customers) is as follows:

	Inquiries	*Complaints*
June	500	20
July	1,000	20
August	800	30

"Since the inception of the plan on July 1, 1942, not one complaint has been received by the State Regulatory Commission."

"The reduction in the number of meter readers exceeds the estimate made at the time the plan was first considered. At that time, it was estimated that the meter reading cost would be reduced about 33⅓%, and you will note that we have released 48 out of 145 meter readers or 36.5% and 25 automobiles, which is more than one-third of the automobiles previously in use."

The almost unanimous approval of this policy by customers, indicated by the few complaints they have made, is evidence of the desire of the American public to cooperate in every way possible in the urgent war problems confronting us.

Regulatory Commissions' Approval

During recent months, the regulatory commissions of several states, including

Wisconsin, Michigan, Indiana, Illinois, New York, Massachusetts, Connecticut, New Hampshire, Pennsylvania, Ohio, South Carolina, Kentucky and Georgia, have issued orders approving the reading of customers' meters less frequently than once a month. In some cases, the Commissions' orders specify that the plan is restricted to rural meters, while in others it is made applicable to all customers, except those with demand meters. The method to be used in computing bills is usually clearly set forth, and in many cases permission is given to eliminate from the bills information previously considered necessary, such as "Meter Reading," "Service From Date," "Rate Information," etc. A few excerpts from the Commissions' orders indicating the cooperation that has been received in the adoption of the plan of reading meters less frequently than once a month are as follows:

Wisconsin

III. Where the estimated bill method provided in Rule I (b) above is adopted, the utility may require the customer to comply with either of the following requirements which the customer may elect to accept: (a) the customer agrees to furnish a deposit equal to the estimated gross bills for any 4 consecutive monthly billing periods selected by the Utility, (b) the customer agrees to permit the disconnection of service pursuant to the utility's filed disconnect rules for nonpayment of a delinquent *estimated bill,* the amount of which is not in dispute.

Michigan

The company will schedule meters to be read every other month except in special cases. In the month during which meters are read, which reading will be for a two-month period, the several blocks of the rate schedule will be applied on a two-month basis. For the intervening month the bill will, under ordinary conditions, be one-half the bill computed for the previous two months. If, in any instance, the past service records are not available or practical for use, then such billing will be based upon such service data as is available. All accounts shall be adjusted, as necessary each time the actual meter readings are obtained. Bills rendered for electric service in months in which meters are not read shall have the same force and effect as those based upon actual meter readings. Any customer considering himself aggrieved by the application of this rule may read his meter and send the readings to the company on appropriate forms which will be provided by the company. The information shown on the bills will consist of the closing date of the period for which the bill is rendered, the net and gross amounts payable, the due date, the statement that any tax which the utility is authorized to collect from its customers is included in the amount billed, together with the name and address of the customer.

New York

Company will endeavor to read meters at regular intervals. Whenever the bill for service is predicated in whole or in part on a demand reading, meters will be read monthly. Whenever the bill for service is predicated on kilowatt-hour consumption exclusive of demand, meters will be read monthly, bi-monthly or quarterly at the option of the company. Company may designate areas within its franchise territory where meters will be read monthly, other areas where they will be read bi-monthly and still other areas where they will be read quarterly.

Ohio

For each month that the meter is not read a bill, equivalent to the bill for one-half of the kilowatt hours used during the previous two months, will be issued and such bill shall have the same force and effect as if the meter had been read. When the meter reading is obtained, a two-months' bill will be computed by doubling the number of kilowatt hours in each rate block of the applicable monthly rate. Such two months' bill will show the gross and net amounts for the two-months' use; credit deductions for the payments made upon the previously issued one-months' bill; and the gross and net amounts presently due. Any customer who desires a reading for the month in which the readings are not obtained may read his meter and transmit the reading on forms furnished by the company.

Pennsylvania

These meters will be read at other than monthly intervals, and for the intervening months between actual meter readings the company will render appropriately marked bills. The bills so provided for the month in which the meter is not read shall have the same force and effect as if the meters had been read for the period, and shall be paid in accordance with the standard payment terms of the applicable schedule.

Connecticut

While there should be some economy due to the reduced car mileage and release of manpower to munition production, the economy is small and the incidental financial advantage to the company is not a factor in the proposal to go on the bi-monthly meter reading at this time. The purpose is as set forth above, conservation of manpower, gasoline and rubber in the National Economy. If, as the termination of the National Emergency, bi-monthly or quarterly reading has been demonstrated as fair and satisfactory to customers, it can be the subject of consideration as a permanent practice.

South Carolina

This Commission feels that the proposed procedure is fully warranted by existing conditions, that the saving in manpower, rubber, gasoline, automobile parts and other critical materials will be a constructive step towards the national war effort and that the company is to be commended for its position in the matter and its desire to so contribute to the war effort. It is the feeling of this Commission that the customers of the company will appreciate the necessity for the installation of the proposed procedure and will cooperate fully in the working of the plan.

Specific Suggestions

Now it is possible that some of you may wish to get some specific suggestions on how to proceed in getting started on the plan to read meters less frequently than once a month. With this in mind, I suggest the following:

(1) Hold a group meeting of your customers' accounting and billing supervisors to discuss the merits of the plan and "smoke" out the objections that may be raised, and decide whether to recommend the adoption of a bi-monthly or quarterly plan, and the method of computing bills.

(2) Decide on the form of bills to be used under the new plan, and find out what regulatory commission rules and regulations may have to be amended in order to enable the company to prepare such bills.

(3) Discuss with the representatives of the billing machine manufacturers the changes that may be necessary in the set-up of your machines in order to produce the customers' bills as proposed by the plan.

(4) Prepare a study of the application of the proposed method of computing bills to a number of residential and commercial customers, selected on the basis of one customer in every 500 or 1000 customers in each consumption group, to indicate the effect on the annual revenue of the company, and on the customers' bills in each consumption group. The increase or decrease per average customer as determined in this study should be applied to the actual number of customers in each revenue or rate classification.

(5) Prepare a study of the estimated annual savings to be realized by the adoption of the plan, based on the reduction in the number of man days, or man hours, automobile mileage and other expenses. These savings should be based on the actual reduction in meter reading work, although they will not always represent actual reductions in expense, because in many cases the men are not released, but a portion of their time is made available for other work. The statement of savings should also show that additional clerical salaries may be necessary in the billing department in order to prepare averaged bills.

(6) Obtain executive approval to all these changes, so that there will be no conflict with any company policy or with the company's public relations.

(7) Present a petition to your state regulatory commission requesting approval of the plan, and asking them to state specifically in their order or rules that the "averaged" bills should have the same force and effect as if the meter had been read.

I venture to predict that the change in meter reading procedure from monthly to bi-monthly or quarterly, will remain with us after the war is over, because the plan works to the benefit of the company and the customers.

List of Bi-Monthly and Quarterly Meter Reading Schemes

THE following tabulation prepared by the Rate Research Committee has been completed since the delivery of the preceding paper and is based on information in EEI files. It is not offered as a complete study but should be useful to supplement Mr. Hardwick's discussion. The list includes companies having bi-monthly or quarterly meter readings actually in effect and those which have obtained permissive orders from the various state commissions. In a number of instances where no date is shown, quarterly meter readings for rural customers have been in effect for some time. In the column "Basis of Interim Readings or Bills" the preferred method is given first. For instance, the statement "estimated or postcard" means that, in general, estimates are used, but postcards may be used at customers' option. The dates shown are those of the tariff sheets from which the information was taken. The Rate Research Committee will welcome advice of any additional companies or additional details. These should be addressed to the EEI Rate Research Committee, 420 Lexington Avenue, New York City.

SUMMARY - TYPICAL COMPANIES

Company	Meter Reading Period-Months	Class of Customers	Billing Period Months	Basis of Interim Readings or Bills	Date
		CALIFORNIA			
Pacific G & E	2	Rural exc demand meters	2	-	9/24/42
		COLORADO			
Public Serv of Colo	(a) Periodic checks	Rural & sparsely pop.	1	Customer reads own meter	7/1/42
	(b) 3	" " "	1	Customer reads or Co.estimate	
So Colo Power	(3)	(All provisions identical with Public Serv of Colorado above)			11/1/42
		CONNECTICUT			
Conn L & P	(3)	All residential, small & medium commercial	1	Estimated or Postcard	9/27/42
Conn Power	(a) 2	All residential, & small commercial	1	Estimated or Postcard	8/10/42
	(b) 3	-	1	" " "	8/10/42
Hartford Elec Light	(a) 2	All residential and small commercial	1	" " "	8/1/42
	(b) 3	-	1	" " "	8/1/42
		GEORGIA			
Savannah Elec Power	3	Rural customers	1	Postcard or estimated	
		ILLINOIS			
Central Ill Light Co.	(a) 2	Residential and Commercial	1	Estimated or Postcard	11/6/42
	(b) 3	Rural	1	" "	
Central Ill P S	2	Residential-selected Comm.	2	-	9/1/42
Commonwealth Edison	2	Residential	1	Estimated	12/1/42
Union Elec of Ill	(Intervals)	Where monthly reading not feasible	1	Estimated or Postcard	9/25/42
		INDIANA			
Public Serv Co of Ind	3	Rural & less than 1000 pop.	1	Postcards	
		KANSAS			
Kansas City Pwr & Lt	3	All but one District	1	Estimated or Postcard	11/ /42
		KENTUCKY			
Ky & West Va Pwr Co	3	Rural	1	Postcards or Estimated	
Louisville G & E	2	Outlying or suburban	1	Postcard or estimated	4/ /42
		LOUISIANA			
Louisiana Pwr & Lt Co	3	Rural	1	Estimated or Postcard	
		MARYLAND			
Cons Gas El Lt & Pwr Co	3	Rural	1	Estimated	
Eastern Shore Pub Ser Co Md	3	Where auto is necessary	1	Estimated or Postcard	5/ /42
Maryland Power & Lt Co	3	Where auto is necessary	1	Estimated or Postcard	5/ /42
		MASSACHUSETTS			
Western Mass Elec	3	Rural & "skips"	1	Postcard readings	4/1/42
		MICHIGAN			
Consumers Power Co	2	Rural residential, commercial & small industrial	1	Estimated or read by cust.	6/1/42
Detroit Edison	2	Residential	2	-	7/1/17
		MINNESOTA			
Miss Valley Pub Ser Co	Periodic	-	1	Read by Customer	7/1/40
		MISSOURI			
Union Elec of Mo	(Intervals)	Where monthly readings not feasible	1	Estimated or Postcards	9/25/42
		NEBRASKA			
Nebraska Power Co	3	Farm	1	Postcards	
		NEW HAMPSHIRE			
Granite State Elec	(3)	Where necessary to curtail	1	Postcards or Estimated	7/1/42
Public Serv of N H)	(a) 3	" " " "	1	" " "	7/1/42
Twin State G & E)	(b) 2	" " " "	1	Estimated	9/1/42

SUMMARY - TYPICAL COMPANIES (Con't)

Company	Meter Reading Period-Months	Class of Customers	Billing Period Months	Basis of Interim Readings or Bills	Date
		NEW JERSEY			
Atlantic City Elec Co	3	Rural	1	Postcards or Estimated	
New Jersey Pwr & Lt Co	2/3	When necessary	1	Estimated or Postcards	7/31/42
Public Serv E & G	3	Rural districts	1	Estimated	9/ /42
		NEW YORK			
Brooklyn Edison Co	(Same as Consolidated Edison Company)				
Brooklyn Union Gas	2		2	-	9/11/42
Buffalo Niagara Elec (a)	2	Kwhr meters at Co. option	1	Postcards or Estimated	5/ /42
(b)	3	" " " " "	1	" " "	5/ /42
Central Hudson G & E	2	All customers on kwhr basis	1	" " "	6/26/42
Central N Y Power	(Same as Buffalo Niagara Electric Corp)				
Consolidated Edison Co of N Y	(Original filing effective Sept 12, 1942 calling for permissive bi-monthly reading suspended by P S C pending hearings which were adjourned to Nov 23, 1942)				
Long Island Lighting	3	Kwhr customers at Co. option	1	Estimated or Postcards	7/6/42
New York State Elec & Gas Co					
Plattsburg District	2	Where autos required	2	-	8/24/42
3 Other Districts	2	Where autos required	1	Postcards or Estimated	5/ /42
N Y Power & Light	(Same as Buffalo Niagara Electric Corp)				
N Y & Queens Elec L & P	(Same as Consolidated Edison Company)				
Niagara Lockport & Ontario	(Same as Buffalo Niagara Electric Corp)				
Rochester G & E (a)	2	All customers on kwhr basis	1	Postcards or Estimated	6/20/42
(b)	3	" " " " "	1	" " "	
Rockland L & P	3	Residential & Commercial	1	Postcards	7/30/42
Westchester Lighting	(Same as Consolidated Edison Co)				
		NORTH CAROLINA			
Carolina Pwr & Lt Co	(Intervals)		1	Estimated	11/1/42
		OHIO			
Central Ohio L & P	3	Residential & Commercial Outside municipalities	1	Estimated or Postcards	8/18/42
Ohio Edison	2	Residential & Commercial Outside municipalities	1	Estimated	6/25/42
Ohio Power Co	3	Rural	1	Postcards or Estimated	
		OREGON			
Pacific Gas & Elec Co	2	Rural	2	-	
		PENNSYLVANIA			
Duquesne Light Co	3	When necessary because of transportation & personnel restrictions	1	Estimated or Postcards	1/4/43
Edison Light & Power (a)	2	(Same as above)	1	Estimated	3/24/42
(b)	3	" " "	1	"	
Glen Rock E L & P	(Same as Edison Light & Power Co)			Estimated	10/1/42
Metropolitan Edison	(Intervals)	When necessary because of transportation & personnel restrictions	1	"	8/31/42
Northern Penna Power Co	2	Res & Comm where necessary	1	Estimated	5/26/42
Penna Edison Co	(Intervals)	" " " "	1	"	9/1/42
Pennsylvania Electric	(Intervals)	When necessary because of transportation & personnel restrictions.	1	"	11/28/42
Pennsylvania Power	2	Residential & Commercial	1	"	7/1/42
Pennsylvania P & L	3	Suburban District	1	"	4/28/42
Philadelphia Elec	3	All except large commercial & industrial	1	"	10/ /42
West Penn Power	(Intervals)	When necessary because of transportation & personnel restrictions.	(Intervals)	-	10/3/42
		SOUTH CAROLINA			
So Car Elec & Gas Co	3	Res & Comm Outside Columbia	1	Postcards or Estimated	9/ /42
South Carolina Power Co	2	Res & Comm Outside Charleston	1	Estimated	6/1/42
		TENNESSEE			
Kingsport Utilities, Inc	3	Rural	1	Postcards or Estimated	
City of Knoxville	3	Rural areas	1	Postcards	9/1/42
East Tenn L & P	3	Rural customers	1	Postcards or Estimated	
		UTAH			
Utah P & L	3	Rural areas			
		VIRGINIA			
Appalachian Elec Pwr Co	3	Rural	1	Postcards or Estimated	
City of Danville	3	Rural users	1	Postcards	
Eastern Shore Pub Ser Co Va	3	Where auto is necessary	1	Estimated or Postcards	5/ /42
		WASHINGTON			
Washington Water Pwr	3	Where auto transportation is required.	1	Postcards or Estimated	7/10/42
		WISCONSIN			
Wisconsin Elec Power Co	3	Where autos are required	1	-	
Wisconsin P & L	3	Mineral Point District	1	Estimated	7/ /42
Wisconsin Public Serv	3	Rural & non-urban		Postcards or Estimated	3/12/42
		WEST VIRGINIA			
Appalachian Elec Pwr	3	Rural	1	Postcards or Estimated	
Wheeling Electric Co	3	Rural	1	Postcards or Estimated	

The Cost of Living and Electric Rates

By F. A. Newton

The Commonwealth & Southern Corporation—Chairman, Rate Research Committee, EEI

EVERY effort is being made to prevent increases in cost of living. For the accomplishment of this purpose various Bureaus and Commissions have been established and orders and directives issued. Recently an amendment to the Anti-Inflation Act was adopted and approved by Congress which reads:

"That no common carrier or other public utility shall make any general increase in its rates or charges which were in effect on September 15, 1942, unless it first gives thirty days' notice to the President or such agency as he may designate, and consents to the timely intervention by such agency before the Federal, State or municipal authority having jurisdiction to consider such increase."

In view of this Act and in view of what has been stated by various persons, it is pertinent to ask two questions at this time with especial reference to the rates to residential customers of electricity in the United States:

1. What part of the cost of living does the cost of electricity represent to the average American family?

2. What is the record of the cost of electricity as compared with the costs of other items going to make up the cost of living? Have the rates for electricity gone up with the cost of living?

The United States Department of Labor—Bureau of Labor Statistics—keeps the record of the cost of living. It is the records of this Bureau which are relied upon in this respect. Among the items which go to make up the cost of living as listed by the Bureau are:

1. Food
2. Clothing
3. Rent
4. Fuel, electricity, etc.
5. House furnishings
6. Miscellaneous

Ordinarily, the fourth item, "fuel, electricity, etc.," represents about 6 to 6½% of the total cost of living. In its report of August, 1940 (Vol. 51, No. 2), the Bureau found this item to be 6.4% of the cost of living. At that time, the Bureau made a special study and breakdown of the item "fuel, electricity, etc." and found that the cost of electricity represented 25% of the total of this item. In other words, 25% of 6.4% or 1.6% of the total cost of living was the item of electricity.

Since that study was made in August, 1940, the cost of living has increased over 15%. At the same time, the price of electricity has gone down. Therefore, it is correct to state that at this time the cost of electricity for the average family represents less than 1½% of the cost of living.

The Bureau of Labor Statistics in reporting on the cost of living as of August 15, 1942, stated that the cost of living is now "19% higher than in August, 1939, just before the outbreak of war in Europe."

Let's draw a parallel of the price of electricity to the American family with the above statement of the Bureau. For the 12 months ended August, 1939, the average rate for residential electricity was 4.05c per kwhr, the average use per family was 881 kwhr and the average annual bill was $35.68. Turning to the 12 months ended August, 1942, the average rate was 3.69c per kwhr, the average use was 1,013 kwhr and the average bill was $37.38.

Here is a reduction of 9% in the average price of electricity while the cost of living was going up 19%. Had the cost of electricity followed the cost of living, the average price per kwhr today would be 4.82c per kwhr or 30% higher than it now is. Since August, 1939, the average yearly bill for electricity has increased $1.70 *but* the average residential customer has increased his use at the same time by 132 kwhr per year. In other words, he has been able by reason of reduced prices to use 132 kwhr more at an additional cost of only $1.70. Today the average customer purchases electricity for his many uses for lighting, appliances, etc., for but slightly over 10c per day.

The average price of electricity to the American family has been going down steadily throughout the years. In 1920 it was 7.45c per kwhr, in 1930—6.03c, in 1940—3.84c and it is today less than 3.7c per kwhr. It is asserted without fear of contradiction that no other industry whose product enters into the cost of living can show a similar record.

These facts are clear and merit serious consideration by American families and by the regulatory agencies of both the State and Federal Governments.

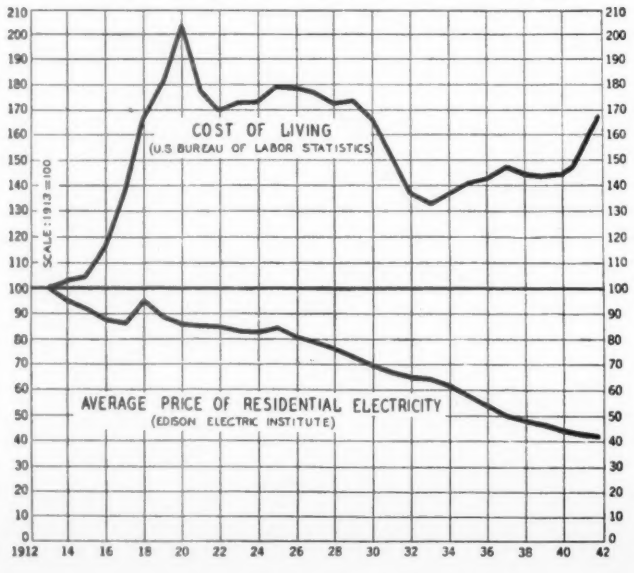
1. The cost of electricity is less than 1½% of the cost of living of the average American family.

2. The cost of electricity to the average residential user is but little over 10c per day.

3. While the cost of living has gone up 19% since August, 1939, the average cost of electricity has gone down 9%.

4. Had the price of electricity followed the costs of food, clothing, rent, household furnishings and other items making up the cost of living, the average price of electricity would today be 30% greater than its present price.

COST OF LIVING AND ELECTRICITY IN THE HOME



War Safety in the Public Utility Industry

By H. O. Sprinkle

Manager of Operations, Monongahela West Penn Public Service Company

A paper presented before the Public Utility Section, National Safety Council, at 31st National Safety Congress and Exposition, Chicago, Oct. 27, 1942

I AM sure all of you are acutely aware of the tremendous impacts of the war on all phases of our personal and business lives. It is perhaps superfluous to tell you that to date these impacts, while severe, have only begun to be felt by the public utility industry except perhaps in the transportation field. It would require, not 20 minutes, but 20 hours or even 20 days to take up all of the new problems the public utility industry faces as a result of the war, and of course I couldn't handle such a job if given 20 years.

Fortunately, however, I was asked to discuss only War Safety in the Public Utilities Industry which is a huge subject in itself, but at least is capable of being condensed into something we can grasp. In tackling this subject it seemed best to write down some of the ways in which war conditions have affected the accident prevention situation in public utility work. In handling this subject please note that I am not a Safety Director. I am talking from an operating man's viewpoint, and if I seem to digress into operating angles of the subject it is only because I am firmly convinced that safety in industry is completely and inextricably tied up with employee peace of mind and job efficiency. Anything which affects these will surely affect the frequency and severity of accidents.

Here is my list as I see the situation:

1. Loss of first line supervisors or foremen.
2. Loss of skilled workmen.
3. Speed-up in production and more work hours per week.
4. Unrest caused by uncertainties of occupational deferment.
5. Unrest caused by rate controversies and labor organizational activities.
6. Civilian Defense activities, especially as they relate to blackout preparations and tests.
7. Substitution of inferior quality of materials in tools and equipment.

Loss of First Line Supervisors or Foremen

I have put "Loss of Supervisors" as number one in my list of war effects on safety because this represents a most serious loss, and one which can hardly be made up. Years of training, familiarity with company policies, methods and specifications, knowledge of personnel, all go to make up the value of a foreman to an organization, and such value can not be replaced on short notice. Any good supervisor represents a minimum of six years' training and generally much more than that.

The loss of a supervisor means a company has lost just that much ability to plan improvements, train present and new workers, and carry out changes in practices as demanded by changed conditions. It is impossible to sell any policy or plan of action to an organization until the first line of supervisors is sold on it. If this group once becomes thoroughly sold the job is 95 per cent done. In the realm of accident prevention practically the entire responsibility rests on the immediate foreman or supervisor of the men. Safety directors, safety rules, safety posters, safety lectures and discussions are all merely means to sell the foreman and make him appreciate his responsibilities. They will be of no avail if he isn't sold because you can not effectively reach the workman except through his supervisor.

As your good supervisors are lost it will become necessary to replace them with less skilled men, and there will be a corresponding deterioration in employee relations, employee training and job efficiency. If I seem to stress this point too vigorously it is because I firmly believe that while the importance of the first line of supervision is generally *admitted*, it is *not relied* upon nearly as much as it should be. In accident prevention work a sincere effort to educate the first line supervisors on their responsibilities will pay big dividends, and when you lose a good supervisor you have lost your best contact with a particular crew of men.

The training of new employees and those transferred from less vital jobs within the company to more important work falls on the first line supervisor. This part of his job will grow in importance as military service and normal causes deplete the ranks of workers.

For these reasons I hold that the loss of supervisors will be the biggest detriment to the cause of safety of any other effect of the war.

Suggestions for alleviating this situation are:

(a) Hold your supervisors by occupational deferment requests if possible.

(b) Pick out your best men with supervisory possibilities and start *now* with their training.

(c) Combine crews under your remaining good supervisors, rather than put up with a too inferior grade of supervision.

2. Loss of Skilled Workmen

Loss of skilled workmen comes next in the order of important effects of war conditions on the cause of safety. As men are taken into the armed services or leave for other jobs, they must be replaced by less skilled workmen, and this replacement can not be accomplished without a pick-up in the acicdent rate.

Some of you may not agree with this because your experience in public utility work has been that the majority of accidents, at least the most severe ones, do not happen to the new men but to the more experienced employees. Our records show this same situation, but a little study shows why the future conditions will be different. In the past we have brought our new men along gradually, moving them from simple work to more skilled and complicated jobs as their ability and training indicated, keeping them under constant supervision and direction. Having once got a man past the apprentice stages, and especially after he reached the skilled classifications, the usual tendency was to leave him alone. He was supposed to know what to do and how to do it. But this lack of attention and slowing down of day by day training has the effect of making a man careless and mentally lazy, and he becomes a good candidate for an accident. When a man gets to thinking he knows

it all he becomes a hazard to himself and his fellow workmen.

Under war conditions when more than ordinary numbers of untrained men will be pushed along or transferred from one job to another, there will not be the usual training given. Loss of supervisors will curtail the continuous day by day training which is the most valuable kind, and the increased speed with which the men are advanced will also cut down the training period.

I feel sure that a serious problem in accident prevention will be presented by the loss of skilled workmen, requiring their replacement with unskilled or less skilled men who can not be given adequate training and preparation for their new work.

The obvious solution is to immediately start training programs to develop your new or less skilled men into good workmen. This has been talked about plenty, but too few companies have started to do it. I think most public utility companies have become so accustomed to stability of labor that they can't adjust themselves to definite preparation for an emergency they will have to face later. We had better get busy.

In such a program don't overlook women, especially mature women, and men with such physical defects as keep them out of the armed services.

Remember this point—*You will have to develop your own replacements because there just will not be any chance of picking up any help from outside your own forces or area.*

3. Speed-up and Longer Work Weeks

Speed-up and longer work weeks are next on my list, mainly because we hear them blamed so much as probable causes of increased accident records. Speed-up is not as serious a problem in the public utility industry as it is in some other industries. In most of our work there isn't much to be accomplished by speed-up, although some pressure will develop for workmen to do more work in a given length of time. The jealous limitations put on production by labor organizations in a great many lines of work tend to eliminate any danger of a man working too hard, and management has less and less to say about it.

It is possible, however, for longer hours to become a factor from a safety standpoint. Fortunately we have the experience of England and other countries to draw from as to the hours per week men and women can work as a continuous program for maximum production. Somewhere around 50 to 56 hours per week, I understand to be the generally accepted figure. This number of hours of work if evenly distributed should cause no accident or health problem, but in many phases of public utility work the hours can not be evenly distributed over the week, especially if the increase in hours comes from a lack of sufficient help.

It is quite probable that a health and accident problem will arise from the longer hours our workmen will be asked to work as the ranks are depleted.

The solution to this problem lies in picking up and training replacements as needed to prevent the overloading of the present forces. This will be very difficult because most skilled occupations require many years of experience and training. All we can do is to intensify and speed up the training of men already partially qualified, and then fill in at the bottom as fast as we can. This program follows right along the program to relieve the loss of skilled workmen discussed in the previous item.

4. Distractions Caused by Occupational Deferment Problem

Next on the list of war effects on safety come the mental unrest and psychological disturbances caused by the uncertainties of occupational deferment. This is almost the universal topic of conversation wherever skilled men and supervisors get together. Even if they aren't talking it, the subject is in their minds.

The problem shapes up about like this:

(a) Instructions and directions from General Hershey's office to local draft boards do not seem to check with public statements made from the same office. Therefore, the action taken by local boards is very confusing to the general public. For instance, many married men with children have been taken in our state but public statements from General Hershey's office would lead one to believe that this group would not be called until late 1943.

(b) We are told to retain men in vital jobs essential to the war effort, but through foggy instructions and directions no company can honestly tell whether or not it is right when it files for occupational deferment for a certain group of men. It certainly doesn't know for sure that it can hold the men for whom it files.

(c) The men are told they are essential and that their employer will try to keep them. Hardly any of t men want deferment, but if they a persuaded that they are in an esse tial industry and that they have essential job in such an industry a that they are of more value in that j than in the armed services, then th will sometimes go along. But wh some local board over-rides a defe ment application and a board of a peals grants a deferment for s months only, the men are all ups A great many in our company want enlist so they pick their service or g commissions, and they can't wait see how a deferment request will co out under present conditions.

(d) This unrest is especially n ticeable in the technically traine groups who have a chance at commi sions or a technical rating of so kind if they enlist. They don't see to like the idea of going in the dra and taking a chance of working the way up.

(e) Pressure is particularly hea from the friends and acquaintances men of military age. Any eligible ma who stays behind when the rest of h group has gone to war is going t pay a heavy price in personal humili tion and hurt feelings unless somethin can be done by uniform or insign to show that he was forced to st on the home front because of his grea er value there.

The Navy methods of recruiting b enlistment only have upset the Selecti Service System and we can't say that w have a Selective Service System in th country. If everyone required by th armed services, including both Arm and Navy, were taken as their numbe came up, we would lose a lot of the pre ent complaints and difficulties.

I feel sure that the present confusio of thinking and uncertainties as to wh to do have introduced inefficiencies i work and distractions to concentrati on the job at hand which lead direct to accidents. I feel that he is a re cause for concern on the part of tho engaged in accident prevention work.

There are one or two things that cou be done to relieve the situation.

First, there could be developed so service ranking with appropriate uniform or insignia for those who are honestly compelled to stay at home because of occupational status. This would not entirely cure the situation, but it would help a lot.

Next, the Selective Service Administration could become consistent in its publ

utterances and its instructions to draft boards. As I said before, we all know that thousands of married men with families have been re-classified and taken into the service. General Hershey knows this, but still we hear that married men will not be called up before late next year. The last few weeks, however, have seen a material improvement in the general situation and the confusion should all be cleared up in about six to twelve months.

Let us hope that some consistency and order will come quickly, and in the meantime try to hold on to your key first line supervisors and start training replacements, because you will need them desperately before this is over. I am afraid we are holding on to too much dead wood in the intermediate supervisory brackets—better take a good look at what you can spare for Uncle Sam. A 10 million man army will leave practically no eligible material for industry, regardless of occupational or dependency status. Secretary Stimson and General Marshall now say that a 7½ million man army is enough. This will help but we ought to prepare for the larger army.

5. Distractions Caused by Labor and Wage Controversies

Mental distractions caused by wage comparisons and labor agitations present problems of mental unrest which have become a contributing factor in causing accidents. When men feel abused or question the justice of the treatment or pay they are receiving, they can't help but let it affect their work. As I have stated before, anything that tends to distract a workman's attention leads directly to loss in job efficiency and to carelessness, and these of course lead right into accidents.

This situation comes and goes in intensity in the different industries, but it is certainly more widely spread today than ever before in our history. In my opinion one need look no further than the disregard of supervisory authority and the continuous state of mental unrest caused by labor and wage controversies to find one of the basic causes for the bad accident records of some of our industries today. If real progress is expected in accident prevention, some easing of this trouble must be accomplished.

It is probably true that the public utility industry, due to its widely known stability of employment and freedom from fluctuations in income, is the freest from such troublesome conditions of any of the larger industries. This problem, therefore, is not of quite such major proportions as elsewhere, but we have it and it is a definite factor when making an analysis of the real causes for accidents. The only way war enters into it is that during the artificial boom times caused by the country spending three times its income every year, spiraling wages and labor scarcity make a rich bed from which the unrest and agitation grows.

I know of no simple solution for this problem. There are always two sides to any question, and generally an important question like this would be fortunate to have only two sides. I do believe this, however—we are going to win this war in *spite* of a number of things, and not *because* of them.

Sabotage of the war effort has a thousand forms and an infinity of gradations. All we can do, regardless of the side we are on, is to be as fair and realistic about the matter as possible every time we are called upon to participate in a solution of a trouble arising from these causes, always remembering that we must win this war and that continuous production is our most powerful weapon.

6. Civilian Defense Activities

Civilian defense activities, especially blackout tests and air raid alerts, impose some additional problems from the safety angle. These are relatively simple, and there are numbers of articles in technical magazines and reports from foreign experiences to guide us in making adequate and safe plans. Consultation with local Civilian Defense authorities for purposes of coordination and advice and a liberal use of common sense should provide maximum safety for personnel.

If we ever begin to sustain air raids of any significance no doubt considerable additional preparations and protective construction will be ordered by the army. In the meantime we must train our personnel and have that big part of the job done and behind us.

7. Use of Substitute Materials

Last on my list are the additional hazards which will be encountered when we begin using inferior materials in our tools and equipment. This is hardly any problem at all now, but if this war lasts three or four more years, as it shows every sign of doing, we will be using plenty of substitutes in our working equipment. A lot of these substitutes may not be so greatly inferior, but we must appraise their weaknesses and train our men how to use them safely.

Right now the principal item of inferior substitution is sisal rope for manila rope. High strength alloy steel will shortly become impossible to obtain for tools and equipment. We still have to learn how to use less satisfactory items.

Obviously we should conserve our present supplies to the utmost. Maybe they will last for the duration if we can sell our forces on the idea of making them last as long as possible.

Let me sum up briefly the most important features of this program to meet the growing effects of war on our safety records.

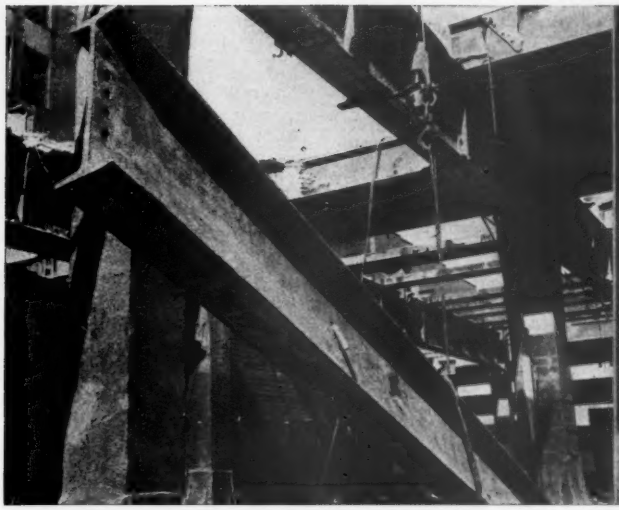
Start training replacements for your skilled men. Move men and women with possibilities from less important or less skilled work to the more important sections. Fill in at the bottom with new employees. Select these new employees from among those not eligible for military service now or in the probable future. Don't overlook married, childless women whose husbands have gone or surely will go into military service. You may have to scrap some ancient and favored policies, but get going *now*.

In your requests for occupational deferments be almighty careful that you can honestly defend the claim for the irreplaceable essentiality of the men for whom you ask such deferment. If you feel desperate enough about it, you can make it stick, provided you haven't weakened your position by a lot of indefensible requests. Withdraw the requests you may have already filed but which you know good and well you can't honestly uphold.

Back up a campaign to secure some military or governmental ranking that will relieve from public ill-will and pressure those men of military age who may be deferred because of occupational necessity. Let's make the Selective Service Authority take some immediate action on this matter.

Be as fair and realistic as possible in labor and wage disputes. Strikes and work stoppages are the most prevalent and potent weapon we could give the Axis, and well they know it. Such things are point-blank sabotage. Maybe we can win the war in spite of them, but they are costing billions of dollars extra and many hundreds of thousands of lives of American boys will be sacrificed to pay for our lost production. Let us hope that the Con-

(*Continued on page* 417)



Heavy girders being removed from the old Edison Station. This is the finest kind of scrap for the Nation's steel mills.

Pile of miscellaneous iron and steel scrap from the old Edison Station ready for transfer to the dealers' yard.

Outstanding Scrap Collection Job

AN outstanding job in scrap collection is being done by the Philadelphia Electric Company in the scrap metal drive.

Recovery of more than 6,500,000 pounds of iron, steel, copper, lead, brass, zinc, tin, aluminum, rubber and other war-needed materials this year is predicted by Henry B. Bryans, executive vice-president.

Much of this material has already been salvaged within the past four months as a result of an intensive drive throughout the company. "Although we have always been active in salvage operations," Mr. Bryans said, "a great quantity of the scrap now being recovered represents material over and above what would normally be collected. The need for scrap is so great that we are digging deeper and deeper. Buildings, substations, and other structures for which no immediate use is in prospect are being demolished for the scrap they will produce."

In this latter classification, is the demolition of the old 8-story Edison Station, which formerly stood at 908 Sansom Street, Philadelphia. Although the building was erected under the personal supervision of Thomas A. Edison, and was the city's first successful electric plant and the first building in the United States constructed specifically as a generating plant, the present emergency forced the decision to raze the building. "The need for this scrap is greater than our natural desire to venerate the old structure," explained Mr. Bryans. "Its million or more pounds of steel and iron are required for the war, and we are glad to turn them back to the steel mills for remelting into planes, guns, ships, and tanks to hasten the day of Victory."

Demolition has also been started on the company's old Swede Street generating station at Norristown, and on the old boiler house building at Cromby.

Employees of the company have engaged in a patriotic and thorough participation in the drive for scrap metal. In addition to active participation in their own communities, employees organized treasure hunts throughout the company and were able to produce thousands of additional pounds of much-needed scrap which otherwise might have been overlooked. Included in the items turned into the salvage depots, which were placed within easy reach of all employees, were metal objects of all kinds, ranging from small items of junk jewelry to loving cups and outmoded paper punches.

Philadelphia Electric employees organized treasure hunts throughout the Company and were able to produce thousands of additional pounds of much-needed scrap which otherwise might have been overlooked. Here are some of the salvage depots photographed in the early stages of the campaign.

Substitutions of Material and Changes in Practice to Meet Wartime Conditions

By L. M. Smith

Electrical Engineer, Alabama Power Company, Birmingham, Ala.

A paper presented before Engineering and Operating Section Meeting, Southeastern Electric Exchange, Atlanta, Ga., Sept. 24, 1942.

SIXTY years ago Thomas Edison at his Pearl Street Station in New York City ushered in the great industry which you and I are proud to represent today. From his age of wax candles and oil lamps, this industry has grown miraculously through the years until it has become the willing servant of farm, factory and fireside, and essential throughout to the peace-time and war-time life of our people.

Our industry has not come to this place of unquestioned importance without its full share of headaches and heartaches. From that 4th day of September, 1882 to this very hour, we have come to know all too well the meaning of emergencies of changes and subustitutions, famine and feast, dreads and hopes, despair and success. But, whatever the state of our health during these 60 eventful years of peace and war, it has become traditional with us to carry on, to explore, to produce, to serve, and to make each year a worth-while challenge for the one to follow.

It is with this proud heritage and vigorous spirit that we come again to a time of great national peril, a time when we must lay aside much of what we have used and learned, valuable as it is, and do the best we can with what we have until another world-wide war has been won.

We do not have to be reminded that before we entered World War I we had material and labor problems, coal and power shortages and daylight saving. And we shall not forget that after our entry in that war we had new transmission line interconnections, executive orders for the conservation of coal and oil, the fixing of coal prices, the use of steel wire for distribution lines and the curtailment of sign lighting. We shall not forget that we had regulation of working hours to avoid peaks, the conservation of raw materials and supplies, a shortage of skilled workers, and—priorities.

Whatever now may be the rules for this new World War of overwhelming proportions, we still have the determination, the technical skill and plenty of originality to get necessary jobs done. We still have, as executives in our industry, competent, resourceful, and far-seeing men who not only permit, but insist on fresh thinking and careful planning at all times and on all problems.

By way of approach, then, to the new realities we early put aside the idea, as we did before, that to maintain even essential service, we could have all that we wanted of everything. Once more we search and re-search for the unorthodox and imaginative methods of design, construction and operation because we know that somehow in this war emergency, as in the last one, they must be used. Once more, we take our shopping lists to the lowly junk piles of our frugal operating men and find there many of the materials that will help us cut the corners and get these emergency jobs done. Once more we wonder if Santayana was not right when he reminded all people everywhere that, "those who will not remember the past, are condemned to repeat it."

That many changes in practices and many substitutions of materials are absolutely necessary at the present time is not to be questioned. Surely we know that our allies and our sons, brothers, fathers and friends in the armed services need ships and tanks and planes and guns and need them badly. Surely, we know that to give them these fighting tools of war, we must tighten our belts, do less traveling and conserve, simplify and eliminate critical materials wherever possible.

It is regrettable, of course, that at a time like this, there should be those who are reluctant to alter their courses, or who find any disturbance to their peace-time routine and standard practice unbearable. To the credit of most of us, however, let it be said that these days of stern realities simply show us where the needs are greatest that we may do an even better job than we did in 1917-18.

Our immediate concern here just now is with those changes and substitutions in materials and practices which already have been made as a patriotic contribution to the total war effort. As would be expected, the difficulties with materials and their deliveries grow, and grow fast under the harsh intrusion of military necessity, so that as the war effort expands, more and more deprivations and adjustments will face us.

In our Company's operations, we already have chosen substitutes for many critical materials and also have chosen some substitutes. We have found a few materials and practices good enough for regular peace-time use, and we hope to find more.

We do not expect, however, great economies to result from many of the temporary measures adopted, because continued first-class electric service at low cost and minimum hazard will require that we return promptly to accepted good practices and better and more suitable materials when the restrictions of war are lifted.

Substitutions and Changes in Practice

A few of the substitutions and changes in practice we have so far put into effect will be described, although, some of these may soon be modified or superseded.

Design and Construction

The substitution of timber "A" frame structures in a new double-circuit 110-kv lines for which plans had already been made to use galvanized steel.

The use of treated timber for substation structures, foundations, pull-box covers and fence posts.

The fabrication of new steel structures from used galvanized steel retired from various jobs.

The use of painted black steel for small structures in place of galvanized steel.

The use of concrete pedestals where practical instead of galvanized steel.

A reduction in the weight of steel substation structures by welding instead of bolting.

The simplification of certain steel column footing designs by the elimination of plate and angle assemblies.

The use of steel bolts in place of copper alloy bolts in low voltage switchgear.

The use of bar copper cable for low voltage buses instead of tubing or bar.

The use of control cable laid directly in the ground in place of lead-covered cable installed in conduit.

The use of single conductor cable, as needed, in place of multi-conductor cable.

A reduction of the insulation thickness in cables to conserve rubber or other insulating materials.

The use of "Danger—High Voltage" signs made of painted masonite.

Substitutions from salvage in line hardware, insulators and other items.

The use of steel wire for short, lightly loaded primary extensions.

The hand-serving of low voltage connections and of light anchor guys to reduce the use of clamps.

The use of wood slug anchors for guys on distribution lines.

The omission of primary arresters, or the relocation of nearby arresters when new installations of distribution transformers of the conventional type are made in the vicinity of existing transformers.

The use of galvanized steel pipe instead of copper for power transformer and circuit breaker oil lines.

The use of steel piping in place of Admiralty metal in new steam plant feed-water heaters.

The use of cast iron terminal connection boxes instead of aluminum boxes in outdoor substations.

The use of special fiber flashing in place of copper for building spandrels and roofing.

The use of masonite instead of sheet steel for the cover and walls of outdoor breaker cabinets.

Operation and Maintenance

The removal of two composite steel and aluminum overhead ground wires on 74 miles of 110-kv line to permit its use as conductors on a new 110-kv line.

The operation of distribution transformers serving residential loads at 150 per cent rating on peaks instead of 135 per cent.

A change in type of multiple street lamp being used, resulting in longer life and a corresponding saving in car travel for replacements.

The replacing of only the phase wire on services where the weatherproof covering has fallen off, leaving the bare neutral in place.

The use of one bare wire on services to housing projects to conserve weatherproof wire.

The use of wood mallets instead of steel sledge hammers for dislodging coal from railroad cars, and ashes from ash cars.

The repairing of worn pump and crank shafts by welding on new material and re-machining.

The repairing of small bronze sleeve bearings, which wear unevenly, by babbitting the worn portion and by rotating the sleeve to bring new bronze into position for wear.

The repairing of large bronze sleeve bearings, where wear is uniform by boring out the bearing to take bushings or by tinning and lining with babbitt.

The use of rubber hose for bushings on pins in flexible couplings of governor pressure pumps.

The making of air compressor belts by cutting good sections out of old and larger belts.

The rebabbitting of stoker line shaft bearings with babbitt made up of scrap lead from old control and power cables.

The making of intricate equipment parts by hand from scrap pile parts, where impossible to buy or where delivery of new parts is unsatisfactory.

The repairing of parts of equipment removed from service years ago because worn or broken and their re-use for emergency service.

The more frequent inspection of generating plant equipment to detect parts that could be replaced or repaired before failure.

The keeping of a complete record of all idle or partially loaded circuits, transformers and other equipment for possible use in an emergency.

Warehouse and Shops

The reworking and redesigning of old hook-stick and gang-operated switches, oil circuit breakers and other equipment for re-use in new construction.

The removal of insulation from old soft-drawn weather-proof wire for use as tie wire in place of purchases tie wire.

The re-use of jewels from meters and instruments after inspection, cleaning and re-mounting.

The manufacture of new relay contacts from salvage materials.

The repair and replacement of broken parts of meters, relays and instruments with bronze, bakelite or steel.

Automobiles and Trucks

The use of trains and buses wherever practicable to conserve tires on Company automobiles.

The resetting of governors on passenger automobiles from 50 miles per hour to 40 miles per hour.

The equalizing of the mileage use of utility passenger cars by a careful control of assignments.

The checking of the air pressure in tires before each trip from the central garage.

The switching of tires on cars more frequently to equalize the wear.

A weekly inspection of the steering mechanism, brakes, tires and lights of line trucks.

The removal of rubber mats from trunk compartments as an aid to the national salvage program.

The rebuilding of automobile engines, transmissions and other parts, for an indefinite period of service.

General

Economies in the use of stationery and a reduction in the number of Company forms and reports required.

Changes in office hours to help relieve traffic congestion on public transportation systems.

The use of women on drafting boards for tracing, mapping, drawing revisions, and the making of charts and exhibits. One woman is also being trained as a meter tester and one is serving as telephone operator in the Chief Load Dispatcher's Office.

The use of girls to replace boys as messengers.

Daily, during this emergency we expect this list to get more lengthy. Daily, we expect that the rules which we shall follow will be more drastic and far-reaching and our practices more irregular and unconventional. But these should not much matter if they help us to win the war and leave us a free people.

Results of Emergency Overload Tests on 24-Kv, 3-Conductor Paper and Lead Cable

By G. B. McCabe and Joseph Sticher

Detroit Edison Company

A paper presented before the Transmission and Distribution Committee, EEI, Cincinnati, Ohio, Oct. 19-20, 1942

WITH the growing scarcity, due to the war effort, of materials essential in the production of electrical equipment, it becomes increasingly important to utilize to the fullest extent the existing facilities for the production, distribution, and utilization of electricity. This dearth of critical materials has served as a stimulus to the initiative and ingenuity of utility engineers to wrest the last possible kilowatthour out of present installations without jeopardizing too greatly their future serviceability.

This paper is concerned in particular with an investigation of the maximum allowable carrying capacities of 24,000-volt, 3-conductor, paper and lead transmission cable. From this study, there were established emergency loadings for these cables which, it is felt, the cables can satisfactorily carry on infrequent occasions without too great a loss of useful life.

General Test Program

This program was carried out in conjunction with the development by The Detroit Edison Company of a method of cooling substation transformers by means of an external water spray which permits emergency peak loads equal to more than twice the normal rated capacity of the transformers to be carried occasionally. For example, a 6000-kva transformer, when sprayed with 20 gallons per minute of 25 C water, carried 12,000 kva continuously with a maximum average winding temperature of 92 C. Thus, in the case of a substation fed by two fully loaded transformers, one such transformer might be removed from service, due to trouble or other causes, for a 24-hour period and the other made to carry the load of both transformers.

Since these transformers are in most cases fed by radial 24,000-volt cables, the allowable loads may be limited by the carrying capacity of the cable as well as that of the transformer. A test procedure, therefore, was developed to determine whether the cable, which is a 2/0 A.W.G., 3-conductor, belted cable in the case of the feed to a 6000-kva transformer, could withstand without appreciable damage emergency loads of the order of those satisfactorily carried by the transformer. About eighty per cent of the 300 miles of No. 2/0 A.W.G., 3-conductor, 24-kv, belted cable, which was operating on the system in 1920, is still rendering satisfactory service. Typical lengths of service-aged cable of the period 1917 to 1920 were, accordingly, chosen for the test.

The test was extended to include, besides the 2/0 A.W.G., belted cables, 350M cir mil, belted and 350M cir mil, shielded cables, the 350M cir mil size, which is our present standard size of 24-kv cable, being employed as the customary feeders to 10,000-kva transformers. The belted, 350m cir mil cables, which were made between 1923 and 1927, had rendered almost continuous service since receipt from the manufacturer, while the shielded cables were new 1941 products.

Test Setup And Procedure

A test installation was made in a 100-ft run of standard 4-inch fibre, 12-duct bank, 3 wide by 4 high, located in yellow clay soil on company property at one of the outdoor substations. In order to simulate actual service conditions, the test cable was installed in one outer duct, another larger cable was installed in a second outer duct to serve as the return path for the heating current in the test cable, and hotbed cables pulled in six other outer ducts were loaded to give air temperatures of 35C in four and 45C in two of the ducts. These duct air temperatures of 35C and 45C represent thermal conditions in the air adjacent to normal cable sheaths having temperatures of 40C and 50C, respectively. Fig. 1 shows the cable arrangement of the cables in the duct bank.

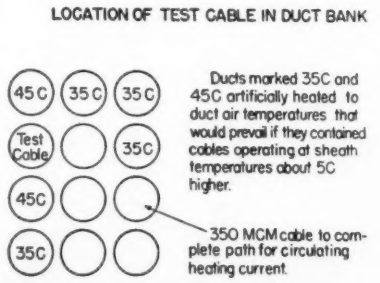

LOCATION OF TEST CABLE IN DUCT BANK
45C
35C
35C
Test Cable
35C
45C
35C
Ducts marked 35C and 45C artificially heated to duct air temperatures that would prevail if they contained cables operating at sheath temperatures about 5C higher.
350 MCM cable to complete path for circulating heating current.

Fig. 1—Location of test cable in duct bank

Test equipment including loading transformers and apparatus for measuring power factor, dielectric loss, temperature, cable movement, internal pressure, etc., which was installed in a portion of a building adjacent to one of the manholes, was utilized to subject the test cable to a series of normal loads and overloads. The selected test schedule required the test cable to be subjected to several normal daily load cycles followed by one emergency daily load cycle. This schedule was repeated at least 4 additional times, providing the condition of the test cable permitted. There are two different types of loads carried by these cables on the Detroit Edison system, one group being residential and the other combined industrial and residential loads. The peak of the residential-type load occurs in the evening after sunset and is usually maintained for 3 to 3½ hours, while that of the combined load is maintained at a fairly uniform level from 7 A.M. to about 10 P.M., a period of approximately 15 hours. Fig. 2 shows an emergency loading schedule which was adopted for the tests on cable feeding a residential substation while Fig. 3 is typical of the combined load. Fig. 2 is the schedule for Test Sample D, and Fig. 3 is for Test Sample F.

The three kinds of cable were subjected to loadings based on both load

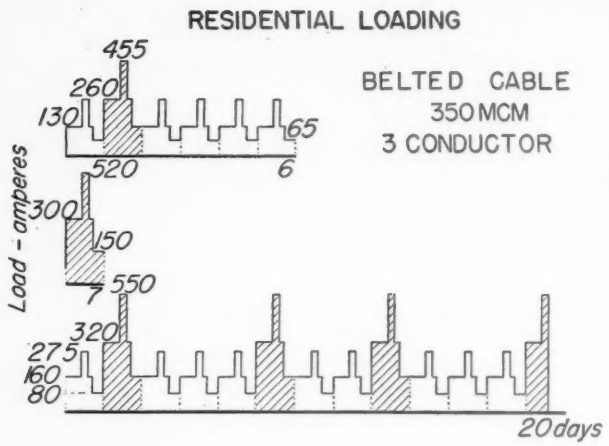


Fig. 2—Type of emergency loading schedule adopted for tests on cable feeding a residential substation. Schedule shown is that for test sample "D." Note 3½ hr emergency peaks

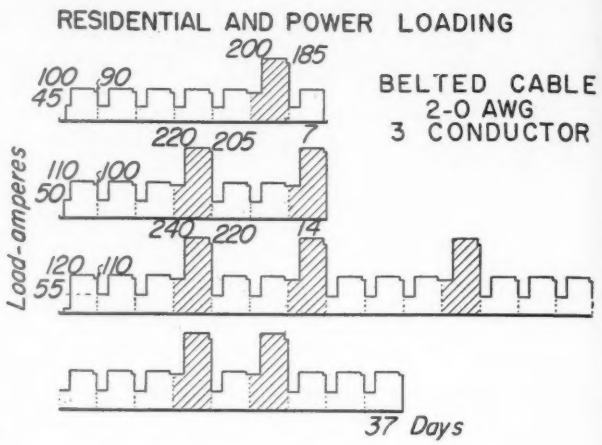


Fig. 3—Emergency loading schedule of the type adopted for combined residential and industrial load. Schedule shown is for sample "F." Emergency peak is 15-hr duration

curves, the maximum load steps being maintained for a period of 3½ hours in the residential and for 15 hours in the combined power and residential schedules. The various loading schedules employed are given in subsequent sections of the paper, the schedules with the highest emergency currents applied to each test length being recorded in Table I.

Each test length was terminated with oil-tight potheads. Some of the lengths were made up with duct-splices and manhole-type joints in order to ascertain how they would withstand the effects of such high emergency loads.

Ten thermocouples, spaced 10 feet apart beginning 5 feet inside the duct were attached to the cable to permit temperature measurements along the cable sheath. Additional thermocouples were secured to the riser section of the test cable and some were placed 25 feet into the four vacant and the six hotbed cable ducts. A thermocouple buried 20 feet away from the duct bank afforded readings of ground temperature.

Conductor temperature measurements were obtained from conductor resistance readings taken immediately at the end of each emergency load step.

Power factor measurements, employing single-phase voltages between 10 kv and 40 kv, were taken at various times before and after the normal and emergency load cycles.

Bend tests and radial power factor measurements were made on a few specimens from the test lengths.

Impulse tests were conducted on samples of the 350M cir mil belted and shielded cable tested.

Readings were also taken at both ends of the test length of longitudinal movement and of pressure inside the cable sheath.

Test Results

RESIDENTIAL SUBSTATION LOADING (3½-HOUR PEAK).

Test Sample A, 2/0 A.W.G., Belted Cable: This test length (1917 cable) was subjected to a loading schedule, as shown in Table I, which required the application of an emergency load of 320 amperes for a 3½-hour period. Since this cable failed during the last minute before the end of the first emergency 3½-hour step, it was evident that the load chosen was too high for 2/0 A.W.G., belted cable of this age and service. Accordingly, the emergency load was reduced to a value of 280 amperes for the tests on Sample B.

The rapid rise in the curve on the recording wattmeter, the dielectric loss rising from about 3 watts per foot at the start of the emergency load of 320 amps to about 55 watts per foot 6½ minutes before failure, warned of imminent failure of Sample A.

The following excessive values were attained in the various readings taken at about the time of failure: conductor temperature, 226 C; average sheath temperature (average of the 10 readings taken during the time of maximum sheath temperature), 118 C; maximum internal pressure, 56 psi; and maximum elongation, 2½ inches per 100 feet of cable (total for both ends of cable).

Examination of the test specimen after removal from the duct disclosed that the sheath had failed at a point where the sheath temperature had reached 132.5 C. For a distance 5 ft each side of the sheath failure, the conductor insulation and much of the belt insulation was found badly charred. Dark brown baked spots in the conductor insulation persisted as far as 12 ft away from the failure.

Test Sample B, 2/0 A.W.G., Belted Cable: This test length (1920 cable) was subjected to a loading schedule, as shown in Table I, which required the application of an emergency load of 280 amperes for the 3½-hour period, a total of 5 times.

The cable withstood this test quite satisfactorily. During the five emergency load cycles, the following values were attained in the various measurements made: conductor temperature, 153.5 C; average sheath temperature, 100.1 C; maximum internal pressure, 8.5 psi; and maximum elongation, 1.44 in.

The dielectric loss reached a fairly high value at the maximum temperatures attained, but does not indicate any imminent failure.

The examination of the cable after removal from the duct revealed that despite the punishment from the above loads and despite an age of almost a quarter century the cable was in such condition as to be deemed fit to be placed back in service, the insulating tapes being well impregnated and containing no carbonization and but little wrinkling and wax.

Test Sample C, 350M-cir-mil, Belted Cable: It was intended to subject this length to a loading schedule requiring the application of an emergency load of 455 amperes, but the sample failed at 35 kv during the power factor test just prior to the first emergency cycle due to moisture which had previously penetrated the insulation through an undetected split in the sheath. To prevent a similar occurrence on succeeding samples, all proposed test lengths were first tested with the kenotron.

Test Sample D, 350M-cir-mil, Belted Cable: This test length (1927 cable) was subjected to six emergency load cycles, the 3½-hour peak values being 455 amperes for the first, 520 amperes for the second, and 550 amperes for the other four cycles. Table I shows the schedule for the heaviest (550-ampere) load cycle.

The cable failed 8 minutes before the end of the last cycle at a point in the riser cable 4 feet below the pothead due to migration of the impregnating compound.

During the 6 emergency cycles, the following maximum values were reached in the various measurements made: conductor temperature, 162.9 C; average sheath temperature, 104.6 C; internal pressure, 52 psi; and elongation, 1.6 inches.

Examination of a number of samples taken along the length of the cable after its removal revealed that the cable was in such good condition as to be deemed satisfactory for return to service. The insulation was uniformly and well impregnated, had but little carbonization and wax, and showed no deterioration of its physical properties.

The dielectric loss curves (Fig. 4) for the four 550-ampere steps indicate incipient failure to be near toward the end of the 3½-hour periods in each case, while the curves for the 455- and 520-ampere cycles indicate that these currents can be safely carried under these emergency conditions.

Test Sample E, 350M-cir-mil, Shielded Cable: This length of 1941 new cable was subjected to six emergency load cycles, the 3½-hour peak values being 565 amperes for the first two cycles and 600 amperes for the last four cycles. Table I shows the schedule for the 600-ampere load cycle.

The cable withstood this test quite successfully, examination of samples revealing the insulation abundantly and uniformly impregnated, and the physical properties unimpaired. In fact, it looked like new cable just received from the factory.

The following maximum values were recorded: conductor temperature, 144.6 C; average sheath temperature 114.9 C; pressure, 40.2 psi; and elongation, 1.15 inches.

A cold bend test, made in accordance with AEIC cable specifications, developed no edge tears whatsoever.

Radial power factor tests of the various layers of conductor insulation showed no difference between new and emergency-loaded cables.

A sample removed from a location adjacent to the point of highest sheath temperature, i.e., 120 C, was subjected to an impulse test. The three conductors failed at 455, 410, and 400 kv, while a new sample broke down at 510 and 450 kv (no oscillogram record on the third conductor).

Because of the excellent impregnation of this cable, the dielectric losses were comparatively low and free from the sharply rising characteristic toward the end of the emergency period, but the internal pressures were reaching values which might eventually burst the sheath.

Combined Residential & Power Substation Loading (15 - Hour Peak).

Table I—Summary of Test Results

Sample No.	Type of Loading	Description of Sample	No. of Emerg. Cycles	Emerg. Cur. Appl. Amp.	Average Temperature C.		Internal Pres. PSI.	Elongation In. per 100 ft.	Ground Temp. C.	Heaviest Sched. of Load Cycles			Remarks
					Cond.	Sheath				Dur. Hr.	Norm. Amp.	Emer. Amp.	
A	Residential 3½ hr. peak	1917, Used Belted 2/0 3-cond.	1	320	226	118	56.0	2.5	19.2	10½ 3½ 3 7	90 160 90 40	185 320 185 90	Failed ½ minute before end of 320-amp. step
B	"	1920, Used Belted 2/0 3-cond.	5	280	139.5 to 153.5	88.5 to 100.1	7.5 to 8.5	1.39 to 1.44	17.5 to 18.3	10½ 3½ 3 7	80 140 80 40	160 280 160 100	Cable did not fail
C	"	1923, Used Belted 350M, 3-cond.	0	Test sample was defective so no results are recorded.									
D	"	1927, Used Belted 350M, 3-cond.	6	1–455 1–520 4–550	106.2 to 162.9	77.0 to 104.6	38.0 to 52.0	0.95 to 1.60	9.2 to 12.5	10½ 3½ 3 7	160 275 160 80	320 550 320 160	Failure in riser 8 minutes before end of 6th cycle
E	"	1941, New Shielded 350M, 3-cond.	6	2–565 4–600	119.3 to 114.6	93.2 to 114.9	23.0 to 40.2	0.97 to 1.15	7.8 to 10.6	10½ 3½ 3 7	160 280 160 80	325 600 325 160	Cable did not fail
F	Res. & Pwr. 15-hr peak	1920, Used Belted 2/0 3-cond.	8	1–200 2–220 5–240	95.9 to 154.3	76.0 to 103.6	2 in. hg. to 5 psi	0.62 to 0.75	16.1 to 17.8	7 15 2	55 120 110	110 240 220	Cable did not fail
G	"	1925, Used Belted 350M, 3-cond.	5	470	118.8 to 143.3	88.9 to 93.1	33.0 to 47.0	1.33 to 1.83	5.7 to 8.9	7 15 2	110 235 220	220 470 440	Failed 18½ min. before end of 5th cy., but not in cable itself. Due to leaky pothead
H	"	1941, New Shielded 350M, 3-cond.	6	2–470 1–520 2–535 1–600	101.0 to 159.4	79.0 to 114.0 (149 Max.)	22.5 to 45.0	1.01 to 1.58	5.6 to 6.1	7 15 2	(120)* 140 (260) 300 (240) 280	(240)* 280 (535) 600 (480) 555	*Sheath failure and hot spot after 11 hrs. of last emergency cycle

* Values in parentheses ( ) are currents during 535 amp. maximum current cycle.

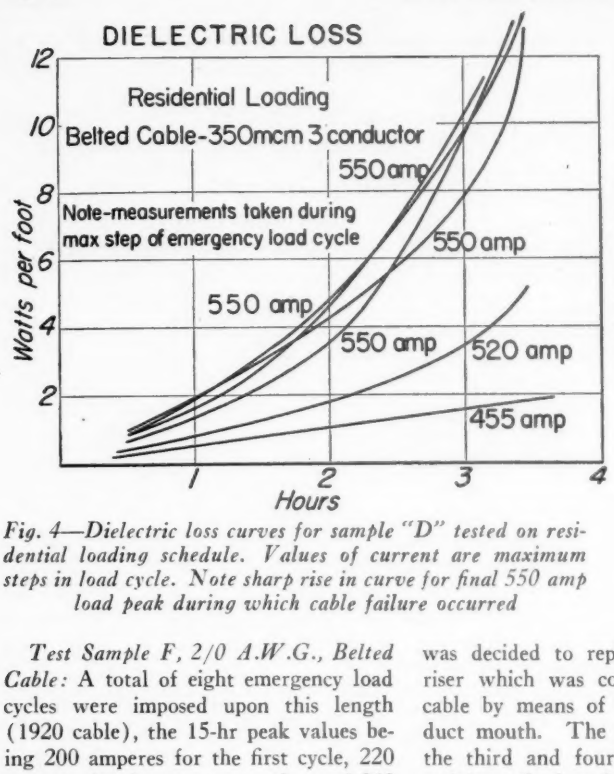


Fig. 4—Dielectric loss curves for sample "D" tested on residential loading schedule. Values of current are maximum steps in load cycle. Note sharp rise in curve for final 550 amp load peak during which cable failure occurred

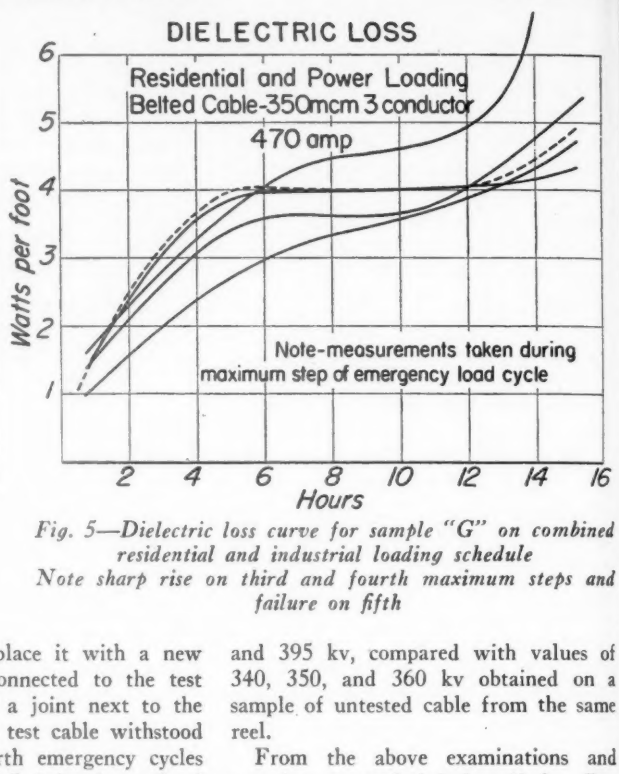


Fig. 5—Dielectric loss curve for sample "G" on combined residential and industrial loading schedule Note sharp rise on third and fourth maximum steps and failure on fifth

Test Sample F, 2/0 A.W.G., Belted Cable: A total of eight emergency load cycles were imposed upon this length (1920 cable), the 15-hr peak values being 200 amperes for the first cycle, 220 amperes for the next two cycles, and 240 amperes for the last five cycles. Table I shows the schedule for the 240-ampere load cycle. The current was increased to the 240-ampere value in order to bring the conductor temperature up to 150 C, the temperature which did not cause any noticeable damage to Sample B during the 3½-hour emergency cycles.

Sample F withstood this test without any trouble and upon examination was found to be in as good condition as Sample B, which was deemed fit to be placed back in commission.

The following maximum readings were obtained during the 240-ampere emergency cycles: conductor temperature, 154.3 C; average sheath temperature, 103.6 C; internal pressure, 5 psi; and elongation, 0.75 inch.

Test Sample G, 350M-cir-mil, Belted Cable: This sample (1925 cable) was subjected to five emergency load cycles, the 15-hour peak being 470 amperes.

Unfortunately, due to leaky capnut gaskets on one of the potheads, a sufficient amount of compound was extruded from the riser portion of the cable as to cause failure during the 40-kv power factor test at the end of the first emergency cycle at a point 9 inches below the pothead. After the pothead was rebuilt, the second emergency load cycle was applied, but such excessive temperatures were developed in the riser that it was decided to replace it with a new riser which was connected to the test cable by means of a joint next to the duct mouth. The test cable withstood the third and fourth emergency cycles satisfactorily but failed in the pothead about 18½ minutes before the end of the 470-ampere step of the fifth cycle.

The dielectric loss curves (Fig. 5) which rose sharply on the third and fourth maximum steps, and particularly on the fifth, presaged thermal instability and ultimate failure, which was undoubtedly due to the loss of oil through the leaky pothead. A dissection of a sample of the cable from the region of highest sheath temperature, 102 C, disclosed the cable to be in excellent condition, it being abundantly impregnated and relatively free of wax and carbonization. This complete impregnation may have been responsible for the high internal pressures, which reached 47 psi, and in a measure for the leaks in the pothead capnuts.

Other maximum readings obtained during the test were: conductor temperature, 143.3 C; average sheath temperature, 93.1 C; and elongation, 1.83 inches.

Cold bend tests on a section from the region of highest sheath temperature produced a few edge tears in the paper tapes, but no more than in a section cut from the same reel length but not subjected to emergency loading, and fewer than allowed by AEIC Cable Specifications.

Impulse tests made on a section of this emergency-tested cable caused breakdown on two of the conductors at 330 and 395 kv, compared with values of 340, 350, and 360 kv obtained on a sample of untested cable from the same reel.

From the above examinations and tests it was concluded that, if the effect of the faulty pothead upon the test results were ignored, this cable satisfactorily withstood five emergency cycles in which 470 amperes were applied on the 15-hour step.

Test Sample H, 350M-cir-mil, Shielded Cable: This section of new 1941 cable was subjected to six emergency cycles, the 15-hour peak values being 470 amperes for the first two cycles, 520 amperes for the third, 535 amperes for the fourth and fifth, and 600 amperes for the last.

The cable successfully withstood all these emergency loads, except the 600-ampere step, which, because of the full impregnation of the cable caused a split in the sheath at a location about six feet inside the duct. This break in the sheath was made manifest by impregnating compound flowing from the duct mouth and by a sudden drop in internal cable pressure, which had previously attained a maximum value of 45 psi about 4 hours before the end of the final 15-hour step. It appears that a modern 350M-cir-mil, shielded cable is so fully impregnated that it can not be subjected to emergency load cycles of 600 amperes without the danger of rupturing the sheath.

This 600-ampere cycle, despite the opening in the sheath, was carried to completion, with the result that the

sheath temperature in the vicinity of the crack reached 149 C, and much oil was lost for a few feet each side of the break, causing charring of the inner third of the insulation and deterioration and lack of oil in the remaining tapes. However, a cold bend test made on a 15-ft section cut starting 5 feet away from the sheath split, produced no edge tears in any of the tapes, and revealed the insulation in good condition and well impregnated.

Impulse tests were conducted on a sample taken next to the bend test sample and produced failures at 370, 315, and 310 kv, which, although considerably lower than the values of 510 and 450 kv, as reported above on Sample E on a new untested specimen from the same reel, still are as high as were obtained in tests in 1938 on three brands of new 24-kv cable, covered in the Minutes of the Transmission and Distribution Committee, EEI, for May 4, 1938.

The dielectric loss curve at 600 amperes had a sharp rise after about ten or eleven hours (at the time of sheath failure), indicating impending thermal instability. However, at 535 amperes peak, the dielectric loss curves had no alarming rise toward the end of the 15-hour period. It can be concluded, therefore, that under the conditions of this test, this cable can satisfactorily carry a peak load of 535 amperes for 15 hours through such emergency cycles.

Summary

From the above tests and dissections, the following observations and conclusions are made:

1. Under the conditions of this test, which, it is felt, are as severe as any ever likely to be encountered in the field, a 3-conductor, 24-kv cable (a 2/0 A.W.G. belted, a 350M cir mil belted, or a 350M cir mil shielded) in a standard 12-duct bank, in which 4 other cables are operating with sheath temperatures of 40 C and 2 other cables of 50 C, when feeding emergency loads for 3½ hours or for 15 hours, dependent upon the type of substation being fed, can possibly go to a conductor temperature of 150 C without causing significant harm to the paper insulation, provided the cable is in the proper condition. At such copper temperatures, the degree of impregnation is an important factor. Very old service-aged cables or riser cables, containing a dearth of impregnating oil, may develop hot spots and fail thermally while cables too fully impregnated may suffer sheath failures from the expanding oil which may drain out and also develop hot spots and thermal failure.

2. Under the conditions of these emergency load tests, internal pressures in excess of 40 psi, in general, appeared to produce sheath ruptures.

3. Curves of dielectric loss on recording watthour meters served as excellent indicators of impending thermal failure. Sharp rises in these curves toward the end of the 3½-hour or 15-hour period presaged failure had the emergency loads been maintained only a little while longer.

4. The older belted cables, which have rendered service for several years, have appreciably higher dielectric losses than the new unused cables. However, the older cables are no more likely to fail because of this higher loss than the new cables unless the load is increased sufficiently to produce thermal instability, which is manifested by a sharp rise in the dielectric loss curve.

5. The duct splices and normal joints, which were constructed in a few of the test lengths, withstood the emergency loads satisfactorily, there being uncovered no signs of deterioration in the hand-applied insulation and no more than normal deterioration, as evidenced by slight wax and infrequent carbonization, in the factory insulation within the joint.

6. Although in many of the tests the longitudinal expansion was between 1.5 and 2.0 inches, the effect of cable movement of this magnitude is negligible since such emergency loads are not expected to be imposed upon the cables oftener than once in five or more years.

7. Bending tests, which were performed according to AEIC specifications on samples removed from the various lengths tested, showed that even in older service-aged belted cable the edge tears were so few as to easily pass the AEIC specifications.

8. Impulse tests which were conducted on samples of 1941 shielded cable from both the 3½-hour and 15-hour emergency test lengths showed some reduction in surge strength from the values for new cable, the average breakdown value of 330 kv for the 15-hour sample being as high, however, as that on three brands of new cable tested in 1938. In the case of the 1925 belted cable there was no difference in surge strength between samples cut from the reel length before and after subjecting to emergency loading.

9. Because of the nonuniformity of the insulation along the length of some of the older cables, the few radial power factor measurements made on the paper tapes were of little value.

10. In accordance with the conditions of these tests, the following emergency loads were satisfactorily carried, a minimum of 5 times in most instances:

	3½-hour Max. Step	*15-hour Max. Step*
No. 2/0 A.W.G. 3-cond. Belted	280 amps (11,650 kva)	240 amps (9,980 kva)
350 Mcm 3-cond. Belted	520 amps (21,630 kva)	470 amps (19,530 kva)
350 Mcm 3-cond. Shielded	600 amps (24,960 kva)	535 amps (22,250 kva)

11. Taking into account the nonuniformities in operating cable lines and allowing for a factor of safety on the above results, The Detroit Edison Company has adopted a maximum allowable conductor temperature of 110 C and has established the following ratings for infrequent emergencies such as may occur not oftener than once every five years:

	3-hour Peak	*15-hour Peak*
2/0 A.W.G. 3-cond. Belted or Shielded	250 amps (10,400 kva)	210 amps (8,700 kva)
350 Mcm 3-cond. Belted or Shielded	465 amps (19,300 kva)	420 amps (17,400 kva)

These emergency ratings are based on 6 cables in a 3 x 4 fiber duct bank, one cable carrying emergency load with the remaining cables normally loaded. Since many of the transmission lines contain both shielded and belted cable, the ratings are based on the carrying capacity of belted cable. It will be noted that, although the selected maximum copper temperature of 110 C is as much as 40 degrees lower than the value of 150 C, which was found to be a safe copper temperature in several of the tests, the adopted emergency load ratings are still almost 90 per cent of the test values. In other words, a relatively large increase in conductor temperature affords comparatively little gain in emergency rating.

In order to provide for emergency overloads occurring as often as once a year, instead of every five years, The Detroit Edison Company has also adopted the following emergency ratings based upon a maximum allowable conductor temperature of 95 C:

	3-hour Peak	*15-hour Peak*
2/0 A.W.G. 3-cond. Belted or Shielded	225 amps (9,300 kva)	200 amps (8,300 kva)
350 Mcm 3-cond. Belted or Shielded	425 amps (17,600 kva)	375 amps (15,600 kva)

Protection Against Sabotage

By J. A. Summers

Nela Park Engineering Dept., General Electric Company, Cleveland, Ohio.

A paper presented at the Wartime Lighting Conference of the Illuminating Engineering Society, St. Louis, Missouri, September 21-22, 1942

THE most important function of protective lighting is to enable guards to see any menace from whatever source which might affect the safety of the property, interfere with production, or interrupt the rapid transportation of war material. Since low levels of illumination usually prevail, it is essential that the lighting be designed specifically to accomplish this purpose. As no two properties are the same, it is necessary to make a careful study of possible places of concealment from which an attack can be launched, places where entrance may be gained, places where fire could be started, and in general study the area to find the most vulnerable points of attack and light these areas so that the guard can effectively perform his duties.

The eye is relatively inefficient in semi-darkness and does not immediately adapt itself to a sudden change in brightness. This is important to keep in mind when designing the lighting because if the guard is in a brightly-lighted area he may not be able to see an intruder at a distant point if the illumination at that point is of the order of a tenth of a footcandle or less. It is not safe to assume that a guard can see an intruder at a distance merely because the illumination at the location of the intruder appears adequate. If the contrast between the intruder and his background is low, he may be invisible even though there appears to be adequate illumination at that point. Here paint can be a helpful ally, to get contrast wherever possible.

The ability to see a source of danger at night depends on the state of dark adaptation of the eye at the moment of observation, on whether it is fixated at the point of danger or roving over the area, and on the alertness of the guard. A roving eye would probably miss a poorly-illuminated point of danger that could be seen distinctly if the eye were focused at the point. A tired or sleepy guard would not notice the faint wisp of smoke or the skulking figure that an alert, wide-awake guard would readily detect. Since safety of the plant is a prime requisite, all of these factors must be given careful thought so that the illumination will provide the seeing conditions necessary for the guard to function efficiently.

While there has as yet been no extensive damage done by enemy-controlled saboteurs, there is ample evidence that plans have been made for the destruction of our factories and transportation systems. There is no doubt that greater vigilance will be required as the war progresses and every vulnerable point of attack must be carefully lighted so that the attack may be discovered in time to prevent the damage. Boundary fences, yards, alleys between buildings, areas along railways and highways, entrances to yards, roofs accessible from adjoining property, areas around parked freight cars, areas around woods and shrubbery, and any place of concealment near the property are some of the most frequently chosen points which, the experience of law enforcement officers indicates, are selected for attack.

Boundary Fences

A strong fence is an essential barrier around any war plant but a fence is not impregnable, and it must be well guarded. Good lighting of the fence line is essential, regardless of what other types of lighting are provided, because it is necessary that the guard be able to see a would-be intruder before the damage is done. The lighting must be sufficient so that the guard can see under the worst conditions, because in bad weather the danger is greatest. It is during rain, snow, or heavy fog, when seeing conditions are poorest, and when guards would like to seek shelter, that the professional saboteur is most likely to be at work. Plant management should help the guards to do effective work under these trying conditions by giving them lighting that makes the danger visible.

The illumination along the fence line should be reasonably uniform, and the spacing of the units should be such that in case of an outage of one lamp, there is sufficient light from adjacent units to prevent an intruder from slipping through the darkened area without being seen. One or more searchlights under control of the guard should be available at strategic locations for emergency use. The area outside the fence to be lighted depends on the terrain, methods of guarding, and places of concealment, such as shrubbery, long grass, piles of material, etc. If in open country with places of concealment readily available, a strip 100 feet to 150 feet wide should be lighted. If the ground is relatively clear and level, half this distance is sufficient. The area to be lighted can easily be controlled by tipping the units up 15 to 40 degrees, or using a unit with the desired distribution. Street lighting luminaires equipped with refractors are the type most commonly used. Any of the well-known refractor types of distribution of light will be found useful under various conditions, depending on location of the patrol road, whether the guards are in cars or on foot, or whether located at fixed stations in towers. Personal preference based on the illumination desired inside the fence frequently dictates the type of lighting used. If no light whatever is desired inside the fence line, the Fresnel type of unit is favored. This unit gives a wide fan of light through 180 degrees on the horizontal and a very narrow beam in the vertical plane. Equipped with a 300- or 500-watt lamp mounted 12 to 16 feet high and 125 feet apart, the Fresnel lenses will give a good illumination for a distance of 150 feet or more in level country. In hilly country, or where there is heavy undergrowth, the results are less satisfactory. One of the advantages claimed for the Fresnel lens is that it is so glaring to the intruder that he cannot see anything beyond the lamps. It is not safe to rely too much on glare, for the experienced saboteur knows the methods of shielding his eyes by looking through long tubes and is able to see beyond the glare zone.

The conventional method of lighting a fence line is to use a refractor unit with a two-way distribution which directs two narrow beams of light 180 degrees apart, giving a band of light along the fence. Five-hundred watt multiple or 10,000-lumen series lamps are mounted in these units 25 feet high on poles

150 feet apart. The poles are placed 5 feet to 15 feet inside the fence in order to prevent them, as well as the luminaries and wiring, from being molested. If the fence is solid instead of wire, it is necessary to mount units approximately over the fence so as to prevent a dark shadow outside the fence. This type of unit is satisfactory to use along highways, railways, and navigable waters, because there is no objectionable glare which would interfere with traffic.

Another method of fence lighting is to place 1000-watt floodlighting projectors at the corners of the property and every 300 feet between corners. This method has been widely used in the past and still finds favor in outlying places where there are no neighbors to be annoyed by the glare. If there are patrolling guards, the projectors should be directed outward with the inner edge of the beam along the fence, so that if the guard looks back he will not be blinded by the glare. If the patrol road is near the fence, the projectors should be aimed in the direction which the guard is patrolling. If the guard is at a fixed station, the projectors should be directed away from his station. Floodlights should not be used along highways, railways, or navigable waters unless the beams of light are directed approximately at right angles to traffic so as not to cause a traffic hazard.

Yard Lighting

While it is of the utmost importance to light the boundary fence, it is not sufficient protection for a property with groups of buildings, storage yards, and railway sidings because of the many places of concealment for an intruder who succeeds in penetrating the fence line or getting into the yard during the day and concealing himself until after dark. A fence is not impregnable and a quick dash at an opportune time to a convenient hiding place in the dark, is quite feasible to a carefully-trained saboteur. It must be remembered that enemy-controlled saboteurs are thoroughly trained in a special school, and they include some of our own naturalized citizens who are thoroughly familiar with the customs of our war industries. No chances can be taken, therefore, in providing convenient dark hiding places where they can wait for the right time to commit their depredations. Incidents have been reported where ambushed saboteurs have attacked guards in the darkness before they could give the alarm. It would be desirable, therefore, in yards that are not well lighted, to have the guards accompanied by trained dogs which would give warning of danger.

Yard lighting may be used in place of, or in combination with, fence lighting, but in all cases it is necessary that the lighting extend at least to the fence, and preferably 50 feet or more beyond. Areas around important buildings should be well lighted and visibility would be greatly improved if a 5-foot band of light paint or white wash were placed around the bottom of all buildings so as to form a light background against which an intruder could be seen at a distance.

There is no standard method of lighting a yard, because of the wide variation in the size and distribution of the buildings and various materials around the yard and the vulnerability to attack from adjoining areas. The system best adapted for the purpose will be determined by the area between buildings, height of buildings, location and height of stored material, location and number of freight cars, adjacent hazards, and the system of guarding. Floodlighting projectors, refractor units, projector spot and flood lamps, and outdoor reflectors will be found useful and all types may be desirable in the same yard. Floodlighting, because of the wide variety of size and beam spread, is probably the most widely used, but caution should be used in placing the projectors so that glare does not become a hazard to street or railway traffic, to navigation or to the guards. Roofs of buildings are convenient locations for projectors, but only in exceptional cases should they be used on buildings less than two stories high. In the open country where neighbors will not be annoyed by the glare, they may be placed on low buildings near the fence and directed outward. In such cases the glare is a deterrent to the intruder and does not interfere with the guard. The same method applies to buildings near a river if the projectors are pointed approximately at right angles to the line of navigation. They should not be used along a railway or street unless the building is at least 40 feet high and the light controlled so as not to obscure traffic signals or interfere with traffic. In some cases a group of projectors on a pole at least 40 feet high located near the center of a relatively large section of the yard may eliminate shadows and reduce wiring. The amount of light required varies from ¼ to 1 footcandle depending on the vulnerability and importance of the location. The number of projectors required may easily be calculated by multiplying the area by the footcandles required, and dividing by the lumens in the beam of the projector used. This may be expressed as a formula as follows:

$$\text{Number} = \frac{\text{Area} \times \text{Footcandles}}{\text{Beam Lumens}}$$

The calculations for a large yard are simplified if it is divided into sections which can be served by projectors from a chosen location. This gives a number of small, simple problems rather than one large, complicated project. If possible, it is desirable to choose more than one location for projectors for a given area so as to reduce shadows from any material stored, or likely to be stored, in the area.

If there are freight cars parked at a loading platform it is important to have light on both sides of the cars because a group can make this a meeting point in which they can hide between, under, on top, or inside of the cars, where they cannot be readily seen. If the platform has working lights, part or all of these may be utilized for one side of the cars and the other side floodlighted from other buildings.

Where buildings are only 25 feet to 50 feet apart, refractor units or porcelain-enameled reflectors may be found more practical and economical than floodlights as they can frequently be served from nearby wiring. With copper a critical material, the resultant saving in wire may be important. The 150-watt PAR-38 projector flood or spot lamps have been used for this purpose. Distributed at upper windows where they are easy to maintain, or mounted in groups on roofs, they have proven very satisfactory for distances up to 200 feet. These lamps have also solved successfully an embarrassing problem encountered by small factories in congested districts that are confronted with complaints from neighboring residents because the protective lighting shines in the bedroom windows. A simple solution is to mount 150-watt PAR-38 projector flood lamps with standard glare shields on about 20-foot centers, at the upper windows or roof. This provides a bright band of light around the factory without any annoying spill of light.

Entrances

All entrances to the property that are used at night should be well lighted for a distance of 50 to 200 feet from the gate. These are the inspection places

for all who enter, and it is necessary for the guard to examine credentials and suspicious packages. If trucks use the entrance it is necessary to examine them for unauthorized passengers or material. The guard should be able to scrutinize approaching persons so as to detect anything suspicious. Thus he will be in readiness against a surprise attack. Light should be provided on both sides of the entrance using street lighting units or industrial reflectors. Floodlighting projectors should not be used unless they can be remounted at least 40 feet high on buildings close enough to the gate to be able to direct the light sharply downward to prevent glare. The same conditions apply to entrances at railway sidings which are even more important than other entrances because of the ease of concealment on freight cars. A minimum average of 1 footcandle should be provided.

Electric Generating Stations

The area around generating stations and substations requires lighting similar to industrial plants, but in addition they have such hazardous locations as the coal pile, coal-handling machinery, water intake, cooling tower or pond, and transformers. All approaches to these critical areas should be carefully lighted because power to vital war industries could easily be interrupted from any of these points. Small bombs which look like coal can easily be thrown in the coal pile or bombs floated in the water. High-tension lines can be repaired quickly, but a damaged transformer may interrupt power supply for a long time. Convenient locations for floodlights can usually be found so that these critical areas can be lighted from more than one direction to reduce shadows.

Bridges

Both vehicular and railroad bridges are particularly susceptible to attack during wartime, because their destruction may seriously interfere with the rapid transportation of vital supplies for our armed forces. Railroad bridges are usually more vulnerable than vehicular bridges because it is not as easy to detour a railroad bridge and because there are fewer people around who would detect any supicious movements. No amount of light will prevent a saboteur from attacking a bridge if it is not well guarded, for he would know whether or not alert guards were present and know their habits, but guards without lights are seriously handicapped and cannot do an effective job.

The important places requiring illumination are the approaches, anchoring piers, supporting piers, and the water for at least 300 feet from the bridge, both up-stream and down-stream, so that a boat or floating matter can be detected in time to prevent damage.

Underbrush should be cleared away from the immediate neighborhood of the approaches so as to remove places of concealment. Both banks should be closely scrutinized for a considerable distance from the bridge for probable rallying points from which to launch an attack and these points be kept under surveillance by periodically directing a searchlight beam to the point.

In general, floodlighting is the easiest way to light the bridge. Groups of projectors are located on both banks of the stream on both the up-stream and down-stream sides of the bridge and directed on the piers and surrounding water. A searchlight under control of the guard should be provided to pick up any suspicious object or movement. Where the bridge is in a populous neighborhood it may be necessary to confine the light closely to the bridge to prevent annoying glare to residents and depend on searchlights to sweep the water periodically to detect approaching danger. Vehicular bridges supplied with street lighting can frequently be lighted more conveniently by tapping current from the existing lines to local units placed on both sides of each pier. Wide-angle floodlights directed to the adjacent pier usually produce satisfactory results.

Dams

In general, the same conditions that govern bridges also cover dams. The main difference is that it is more difficult to approach a dam from the down-stream side and it is easier to quickly float destructive explosives from the up-stream side because the current is more rapid. If the dam is supplying a vital utility, exceptional vigilance is necessary at the anchorages, and on the up-stream side of the dam. Sufficient explosive to wreck the dam can be floated almost submerged and is difficult to detect. An uncontrolled float might miss a bridge but it would not miss the dam. It is important therefore to have a searchlight to pick up distant objects and detect suspicious movements a long distance away.

Piers and Docks

The lighting around piers and docks must be carefully planned so that the direct glare from the light source or the reflected glare from the water does not interfere with navigation. For this reason local lighting units are preferred to floodlighting unless the floodlights can be placed high enough or at a suitable location so that the glare will not interfere with navigation. If the piers are covered, industrial reflectors may be placed along the sides or roof of the structure, being careful that they do not extend beyond the pier where they might catch in a ship's rigging. In some sections of the country the authorities require lighting under the pier to prevent small boats from harboring there in the darkness. Small piers can be so lighted with vapor-proof units under the floor; larger piers may use the 150-watt PAR-38 projector flood lamps. They are usually mounted at the water end of the pier and directed toward the land end so that inspection can readily be made by patrol boats. If the guards are on shore the projectors should be mounted at the shore end, pointing out. In critical areas a searchlight to sweep the waters periodically, helps to detect suspicious craft and avoid the danger of attack. Marine regulations must be followed in all cases where light sources are visible from navigable waters.

Wiring

Since safety is of fundamental importance in protective lighting, it is obvious that every precaution must be taken to prevent any tampering which would endanger the lighting. If the wiring is easy to cut, this would be the first point of attack. If possible, put the wiring under ground or in conduit. A closed loop circuit offers some protection to exposed wiring as it would have to be cut at a number of places before much lighting would be effected. Feeding each group of projectors from a different circuit helps prevent simultaneous outages over large areas. There is no quicker way of destroying the protective lighting than by cutting the circuits. The more difficult it is to do this the less is the danger of sudden darkness at a critical time.

Sky Glow

Along the coastal areas it appears necessary to minimize upward light which might contribute to the sky glow against which enemy raiders can see a ship in silhouette. How much screening of upward light is necessary depends on the amount of protective lighting and how close it is to other larger areas of artificial illumination. Tests are at present being conducted to determine how

(*Continued on page* 423)

Serious Shortages in Manpower for Appliance Maintenance Disturbing to Dealers

An Analysis of Report on Utility Appliance Maintenance

RECENT data obtained from operating companies show a mortality as high as 50 per cent in appliance dealer establishments in the first 10 months of the year in certain areas, while other areas have suffered no losses. Even more striking is the range in number of domestic customers per service dealer. In one area, 4670 domestic customers to each appliance service establishment is reported, in contrast to an average of 318 customers to each dealer in another. However, some progress is noted in obtaining and training repair and maintenance service personnel replacements.

This information was obtained from data published in an interim report of the EEI Appliance Maintenance Committee issued in November and supplementing the report of the Committee on Utility Appliance Maintenance and Repair Programs distributed to member company commercial executives in July. The first report summarized the results of a survey of the policies and practices of 175 representative utilities in carrying on maintenance and repair programs.

Statements in the interim report were obtained from several companies surveyed in the original report. The statements evaluate progress in maintenance activities, the present situation as to manpower and training, dealer mortality and dealer cooperation in appliance repair programs.

Many trained appliance repair service men have joined the armed forces, while others, attracted by higher wages, have gone into industrial defense plants. This shortage of manpower, coupled with rapidly diminishing stocks of electrical merchandise, is forcing many appliance repair dealers out of business, with every indication that the rate of dealer mortality may increase.

It was generally indicated by the companies reporting that repair dealer mortality presents one of the most serious problems to the utility as trained manpower and repair part shortages become more acute, and as utility customers wish to maintain in working condition the appliances they now own.

Table I compiled from data submitted by light companies, indicates the wide variation between companies as to the number of domestic customers for each appliance repair dealer. It also shows that the extent of mortality of appliance repair dealers varies widely.

Dealer Servicing Conditions

To determine the long-range effect of the draft on appliance service men, and the condition of transportation facilities, a utility serving a small area in the Middle West conducted a fact-finding study of the status of manpower and general servicing conditions. The results and conclusions from this study are here summarized:

"Service is of paramount importance today in the activities of utility companies. It is, therefore, extremely necessary not only that service be perpetuated, but that everything be done to improve the quality of the service rendered the customer.

"We believe that the following information obtained in a recent survey made in an area covering some 33 towns of approximately 10,000 customers should go far in helping us to understand our general service problems. We believe that the information obtained in this survey may be of some value in ascertaining conditions prevailing in other territories.

1. Number of Dealers Surveyed, 52. The radius covered by these dealers varied from ten to fifteen miles, although a few served only their immediate town.
2. Approximate Age of Service Men
   a. 20 to 30 years old.... 6
   b. 30 to 40 years old....16
   c. 40 to 50 years old....20
   d. 50 or more years old.10
3. Marital Status
   3. Married 46
   b. Single 6
4. Dependency
   46 service men had dependents.
5. Transportation Facilities
   a. 24 had trucks
   b. 31 had cars (3 service men had a car and a truck)
6. Condition of Tires on Vehicle
   a. Good 21
   b. Fair 31
   c. Poor 3
7. Age of Vehicle
   a. 31 vehicles were 1 to 6 years old
   b. 24 were 6 years old and over
8. Appliances Serviced

	Electric	*Gas*
a. Refrigerators	36	5
b. Ranges	25	9
c. Water Heaters	23	7
d. Washers	38	..
e. Small Appliances	34	..

9. Makes of Appliances Serviced
   a. 21 serviced all makes.
   b. 31 serviced only specific makes, e.g., General Electric, Westinghouse, Hotpoint, etc.
10. Principal Business
    a. Service 21
    b. Plumbing 6
    c. Retail sales, e.g., appliances, furniture, hardware, etc...25

"The approximate ages of the service men show that the highest percentage are in the higher age brackets; hence, the imminence of these men being drafted is more remote than for those in the lower age brackets which are in the minority. Furthermore, out of the 52 dealers surveyed 46 were married (36 of whom had children), while only six were single.

"Transportation is a vital function in the perpetuation of customers' service. The condition of the tires of these service men's vehicles is also favorable. Twenty-one vehicles had good tires, 31 fair, and only three poor. The age of the vehicles themselves is not very encouraging. Thirty of them were from one

TABLE I

Company	*Type of Area Served*	*No. of Domestic Customers Per Service Dealer*	*Est. Dealer Mortality (10 Months)*
A	Metropolitan (Medium)	980	10%
B	Metropolitan (Large)	2085	None
C	Metropolitan & Scattered Areas (Large)	640	20-50%
D	Metropolitan & Suburban (Medium)	4670	30%
E	Scattered Areas (Medium)	3971	50%
F	Scattered Areas (Small)	318	28%
G	Scattered Areas (Large)	471	2%
H	Scattered Areas (Small)	1735	20%

to six years old, while 24 were six years and over. However, it can be assumed that the rate of depreciation of a service vehicle is not as great as that of a pleasure car.

"There is great variation in servicing particular appliances. The greatest number of appliances receiving service are refrigerators and washers. However, it may be assumed that since many dealers now must make their livelihoods primarily through service, they will turn to servicing all types and all makes of appliances.

"The information on the principal businesses of these service men shows that only 21 out of 52 confined their efforts solely to service. The others, it appears, were in the service business as a necessary function of their sales in general. The 21 dealers who were primarily in service rendered service on all makes and all types of appliances, while the others serviced only particular types and makes."

Growth in Appliance Service Repairs

For several years a number of electric utility companies have endeavored to secure from dealers monthly reports on appliance sales. With the servicing of appliances growing in importance, increasing attention is being given to the securing of accurate statistics on the number and type of appliances serviced monthly by the dealers. Table II, prepared by one organization, indicates both the success of an electric appliance service plan, outlined in the initial report, and the sharply increased number of repair jobs per week per dealer.

Table III gives a breakdown of the types and number of repair jobs in a four months' period, as reported by another company.

Training of Appliance Service Men

The eight utilities under study which have dealer appliance service plans in operation report that training of service people, both men and women, is either being carried on presently or plans being formulated for the inauguration of such a program.

Some comments received from seven of these utilities, indicating their experiences in conducting training schools or plans for inaugurating training programs, are quoted as a possible guide to other utilities working on this problem.

Company 1 — Experienced manpower has become Problem No. 1 in repair service business. Our solution has been to work through the Northern California Electrical Bureau to establish a training program in vocational schools in this area. A curriculum has been prepared which will give trainees approximately 80 hours of work on fundamentals of electric appliance repair.

Classes have been established in four cities served by the company, and a total of approximately 125 trainees are taking the course. When this activity was planned, it was agreed that trainees should be limited to men over 50 or who had some physical disability and to women. Before classes were organized, repair dealers in each locality were given questionnaires to fill out in order to determine what type of persons were needed. Based on this information, classes were formed and as rapidly as trainees become proficient we anticipate that they will be employed as helpers or apprentice service men by dealers in their special area. New classes will be started as present ones are finished.

Company 2 — Several attempts have been made to start training classes for appliance salesmen and service men but without success. Several of the large manufacturers, who have appliance repair training courses on their own line of merchandise, have and are holding "refresher" classes. Two of the largest city high schools have set up rather limited appliance repair training classes but the probability of young men being drafted and the attractive wages of local defense plants have limited the attendance at these schools far below expectations. A few local dealers have attempted to train young men but again find that they are unable to compete with the attractive earnings of defense plants.

The facilities of this company's Appliance Repair Department, for training of dealer repair men, have been offered and to a limited extent utilized. The available manpower for this type of work is decreasing but at a lesser rate than prevailed four to six months ago. The outlook for new men to be trained for the work is poor. This company, along with some of the other dealers, is giving serious consideration to the use of women in the appliance repair field and here again the principal difficulty is the high wages offered women defense workers in local plants.

Company 3 — The State Electrical League, in cooperation with the Vocational Training Department of our city School Board, is sponsoring an electrical repair course, which started November 2, which will cover a period of eleven weeks. All phases of appliance servicing will be covered, including shop management, tools, and shop practice. The course is free to any who may care to take it. An examination will be given all applicants, however, before admittance to the class, to determine their adaptability to this sort of training. Both men and women may apply for this training.

Company 4 — Dealers are experiencing much trouble in securing repair men, and this is going to become one of the most serious problems affecting the appliance repair business. A recent survey of dealers indicated that women and men above the draft age would be employed to repair appliances, providing they were properly trained.

Company 5 — Our Dealer Coordinators have been working with appliance repair dealers to assist them in the manpower problem. They have succeeded in securing a number of high school boys to do some of this work, and the dealer coordinators have been holding training clinics for the dealers to help train this type of personnel.

In addition, we held a training school assisted by the manufacturers and jobbers in the territory for dealers and their personnel, together with other interested people and succeeded in securing some additional repairmen. We now have plans tentatively developed to train women in this line of work through the Government's vocational facilities. We are very hopeful that this plan will develop sufficient personnel to take care of the appliance dealers in our territory. However, this will take time.

Company 6 — The manpower problem for appliance servicing is of two kinds. One is keeping present service men on the job rather than having them drift into higher-paid jobs, and adding new service personnel to replace those that cannot be so retained, or that go into the military service. There have, of course, been losses of appliance service men in our territory, but we believe these have been minimized because of constructive work done with service dealers early this year, pointing out the growing importance of service, and helping them put their service operation on a paying basis so that dealers themselves would take such steps as they could to retain their personnel.

(*Continued on page* 423)

TABLE III—FOUR MONTHS' TOTAL

Appliance	*Average No. of Dealers*	*Jobs*	*Average Jobs per Dealer*
Cleaner	114	5,556	48
Ironer	48	1,289	28
Radio	118	41,480	351
Refrigerator	66	21,308	323
Roaster	20	677	33
Washer	112	22,340	200
Mixer	55	1,668	30
Iron	118	14,421	122
Percolator	28	1,643	58
Toaster	70	4,408	63
Waffle Iron	24	462	19
Lamps	71	2,946	42
Miscellaneous	90	6,252	69
Total	176	124,450	

NOTE: Breakdown shows number of dealers reporting repairs on each type of appliance. Many dealers specialize on some appliances and do not repair other types.

TABLE II

Date of Survey	*Total Number of Repairs*	*Number of Dealers Reporting*	*Average Repair per Dealer per Week*
March 16 - March 28	3,932	74	26
March 30 - April 11	6,545	97	33
April 13 - April 25	6,546	96	34
April 27 - May 9	6,018	87	34
May 11 - May 22	5,924	86	34
May 25 - June 6	6,299	85	37
June 8 - June 20	6,576	82	40
June 22 - July 4	6,911	83	41
July 6 - August 1	13,418	70	47
Aug. 3 - Aug. 29	14,018	74	47
Sept. 1 - Sept. 30	13,524	71	47

Lettering on Engineering Drawings

By F. P. Kuhl

Chief Draftsman, Consolidated Edison Company of New York, Inc.

LETTERING on engineering drawings is essential to the finished job. It will enhance or detract from the appearance of the work depending on the proficiency with which it is executed.

Fast, symmetrical free-hand lettering, the good draftsman's stock-in-trade, is the result of many years of practice. Such draftsmen are hard to find today.

Therefore, mechanical means must be substituted wherever practical to obtain presentable and legible drawings. Use of mechanical guides is an excellent means of obtaining precision lettering, but is likely to be too slow for general use.

A new type of guide is illustrated in Fig. 1. It is semi-mechanical and employs fixed slots for controlling the height of letters. This guide may also be made in the form of an adjustable parallelogram from which a letter of any desired height may be obtained within the limits of the parallelogram side arms.

With the "slot type" guide no attempt is made to keep the vertical lines of each letter parallel. It is possible to keep the height of all letters equal by simply allowing the lettering medium to strike the upper and lower limits of the slot in the guide, thereby keeping lines of lettering parallel.

Spacing between lines of lettering is obtained by the use of guide lines which are engraved above and below each slot

(*Continued on page* 424)

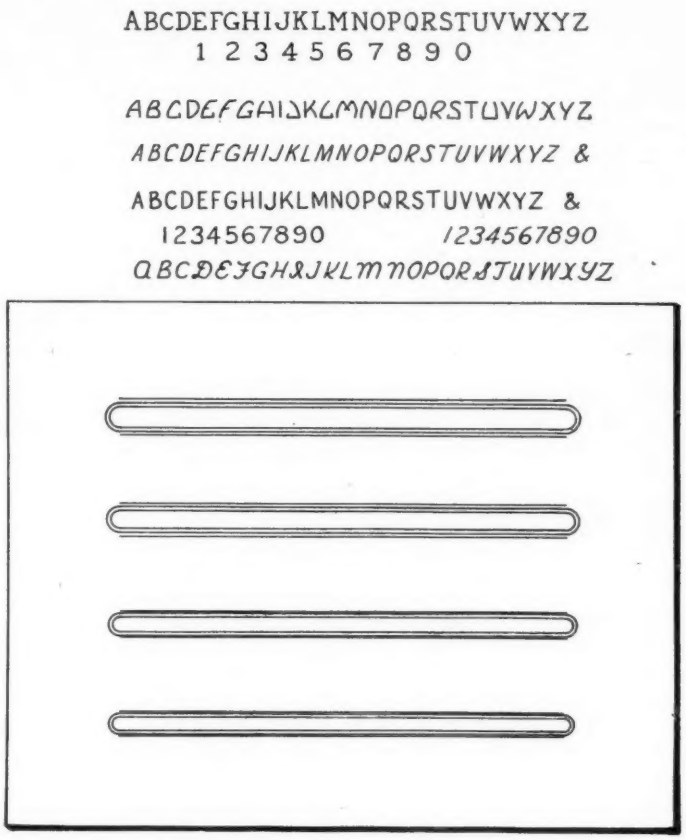


Fig. 1—Slot type guide and sample lettering

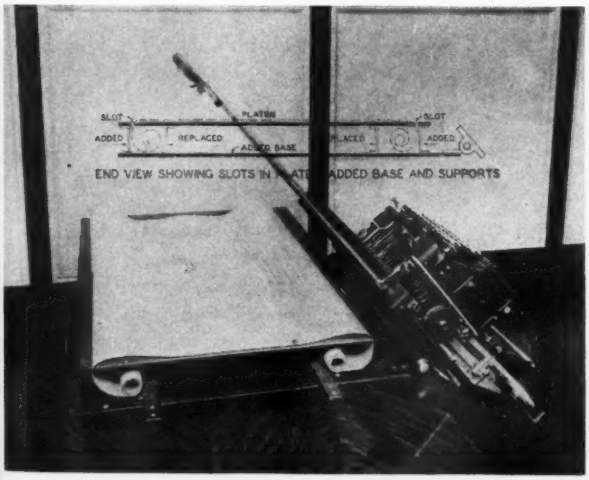


Fig. 2—Method of loading machine (new sub-base, slots in platen, and supports are visible)

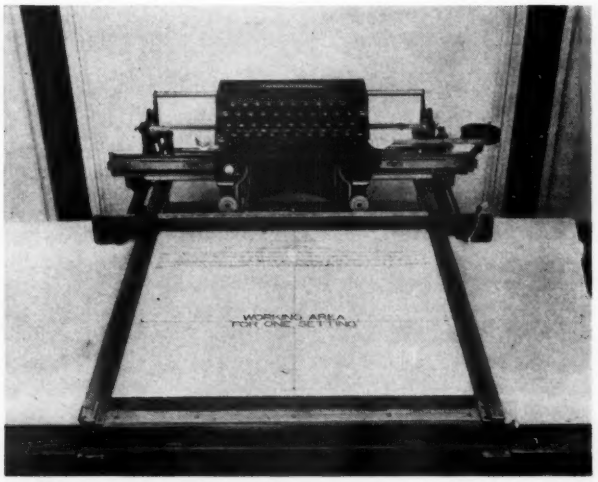


Fig. 3—Machine loaded, drawing clamped and ready for typing. Working area, 18" x 16", for one setting is plainly visible

Floyd L. Carlisle

FLOYD L. CARLISLE, Chairman of the Board of Consolidated Edison Company of New York, Inc., and of Niagara Hudson Power Corporation, and a former member of the Board of Trustees of the Edison Electric Institute, died on Nov. 9 at the North Shore Hospital, Glen Cove, L. I., of an embolism. He went to the hospital on Oct. 25 for rest and observation, and his condition had been reported consistently good.

Mr. Carlisle was born in Watertown, New York, on Mar. 5, 1881. His preliminary education was received in the public schools of Watertown and Dayton, Ohio. In 1903 he graduated from Cornell University, where he studied law.

Mr. Carlisle was admitted to the New York State Bar in 1905, after studying law in the office of Brown, Carlisle and Hugo at Watertown, of which his brother, John N. Carlisle, was a partner. For several years thereafter he practiced as a member of that firm which later became Carlisle & Carlisle.

His first business venture was the organization of the Northern New York Trust Company at Watertown, formed by the merger of two banks into one of the first trust companies in northern New York. Mr. Carlisle served as president of this bank from the time of its organization in 1910 until 1922. In 1916 he headed a group of business men who purchased control of the St. Regis Paper Company. He served first as assistant treasurer of this company, later as president, and was chairman of the board at the time of his death.

Mr. Carlisle entered the public utility field in 1920, heading a syndicate which bought the Northern New York Utilities, Inc., the largest public utility operating company in the northern New York region and became the chairman of the board of directors. In 1921 he came to New York to establish the firm of F. L. Carlisle & Co., Inc., which conducted an investment banking business up to 1934.

In 1926, under Mr. Carlisle's direction, the Northeastern Power Corporation was organized. This company took over control of the Northern New York power properties and in addition acquired a substantial interest in the New England Power Association and Mohawk Hudson Power Corporation. In 1928 the Northeastern holdings in New England Power Association were sold and Mr. Carlisle relinquished his position as chairman of the board of directors of that company.

He played a prominent part in the formation of Niagara Hudson Power Corporation in 1929, becoming chairman of the board of directors. From April 1930 until December, 1933 he was a director of the National City Bank.

His first connection with the Consolidated Edison group came with his election as a director of the New York Edison Company in May, 1930. In February, 1931 he was made chairman of the board of directors of New York Edison. In May, 1930 he was elected a trustee and in February, 1932 chairman of the board of Consolidated Gas Company of New York, which later became the present Consolidated Edison Company of New York. Mr. Carlisle was the guiding figure in the series of mergers of subsidiary companies into Consolidated Edison, which resulted in a greatly simplified corporate structure.

During the years 1930-1934 he served at various times as a director of The United Corporation, Columbia Gas and Electric Corporation and United Gas Improvement Company, and until his death served as a director of affiliated companies of Niagara Hudson and Consolidated Edison.

Mr. Carlisle was married in 1912 to Miss Edna Rogers of Watertown. They have four children, John W., Mrs. Richard Wright, Floyd L., Jr., and Mrs. Crowell Hadden, 3d, who make their home at Locust Valley, N. Y.

Frank R. Phillips

FRANK REITH PHILLIPS, Chairman of the Board of the Philadelphia Company & Subsidiary Companies, died on Oct. 23, at his summer home at Valley Forge, Pa., after a short illness following an operation on Sept. 30. He was born in Cleveland, Oct. 29, 1876.

Mr. Phillips retired from the presidency of the Philadelphia Company on Jan. 20, 1942, following more than 32 years of service with the company.

Following graduation from secondary school, Mr. Phillips entered the Case School of Applied Science, where he studied engineering subjects, later supplementing this with three years of law at Adelbert College, now Western Reserve University, Cleveland. While studying engineering, he was Apprentice Engineer in Hull Design for the Cleveland Shipbuilding Company.

After completing his education, Mr. Phillips became Master Mechanic of the Cleveland City Railway Company. Following this, he was connected with other utility companies coming to Pittsburgh in the fall of 1909 to assist in the development of the street railways in this city. He pioneered in the development of the low-floor, center-entrance car, so successful in present day street railway operation.

In 1910 Mr. Phillips was made Superintendent of Equipment of the Pittsburgh Railways Company, a position he filled until July 1923, when he was made Acting General Manager for the Receivers following the death of the late P. N. Jones. Upon the lifting of the Receivership, Feb. 1, 1924, Mr. Phillips was made Mechanical and Electrical Engineer and was also appointed the representative of the company to the Traction Conference Board.

On Sept. 1, 1926, Mr. Phillips was elected Vice-president and General Manager of the Duquesne Light Company and its subsidiaries. In April 1928, he was elected Vice-president of the Equitable Gas Company and its subsidiaries. In May, 1929, he became Senior Vice-President of the Philadelphia Company and President of its subsidiary companies. And in April of 1931, he was elected to the presidency of the Philadelphia Company and Subsidiary Companies.

Among Mr. Phillips accomplishments as an engineer was the design of the low-floor, high-speed, all-steel interurban car of the type which has since been made standard on the Pittsburgh Railways Company lines, and activity in the construction of one-man cars and those used in multiple operation.

He also originated, designed and developed the low-floor street-car involving the principle of small diameter wheels, and assisted in the re-design of uni-directional relays for automatic isolation of grounds and transmission circuits.

Surviving Mr. Phillips are his wife—Mrs. Stella Newman Phillips, three daughters—Mrs. Charles C. Zimmerman of Houston, Texas; Mrs. Charles R. Ellicott, Jr., of Valley Forge, Pa.; and Mrs. L. H. Phillips of Pittsburgh; and five grandchildren—Virginia Phillips Zimmerman, Jeanne Zimmerman, Cynthia Anne Ellicott, Jane Hamilton Phillips, and Frances Reigh Phillips.

Joseph F. Porter

JOSEPH F. PORTER, Chairman of the Board of the Kansas City Power & Light Company, died Nov. 7 at Trinity Lutheran Hospital, Kansas City, Mo. Mr. Porter had been ill for approximately the last eight months.

Mr. Porter was born in Woodbine, Iowa, on June 27, 1863, received a B.C.E. degree in 1884 and an E.E. degree in 1934 from Iowa State College and an LL.D. degree from Missouri Valley College in 1933. When he was 22 years old he gave up a position in a bank to become an oiler and general utility man in the plant of the Des Moines Edison Light Company. Subsequently he worked at the Edison plant at Appleton, Wis. with the Edison Company in Chicago and at Abilene, Kan., serving as a wireman and in other positions affording practical experience.

In 1887 Mr. Porter went to St. Louis as foreman for the Western Electric Construction Company and then entered electrical contracting for himself. In 1889 he sold out to the Edison United Manufacturing Company and came to New York as a departmental manager for the Edison Company. In June of 1892, Mr. Porter first worked in Kansas City installing the electrical equipment for the Kansas City Elevated Railway Company. This work was completed in 1893 when he returned to Alton, Ill., as President of the Alton Gas and Electric Company and of the Alton, Granite and St. Louis Traction Company.

In 1906, he went to Davenport, Ia., as president of the Tri-City Railway and Light Company, which also covered Rock Island and Moline, Ill. He was Vice-president of the German Savings Bank, 1912 to 1917; chairman of the executive committee of the United Light and Railways, 1912 to 1915, and President of the Cedar Rapids and Marion City Railway Company, 1912 to 1915.

President of the Kansas City Power & Light Company from 1917 until 1938, the story of the company's growth and expansion is the story of a great man's keen foresight and executive ability. Although his retirement from active management of the company in 1938 freed him from the detailed responsibility for the company's operations, Mr. Porter was in his office on the eighteenth floor almost regularly up to a few months before his last illness.

In the civic and business history of Kansas City, Mr. Porter played a vital role. For many years he was active in the Chamber of Commerce. In 1931, Greater Kansas City paid homage to his ability and accomplishments by a dinner, sponsored by the Chamber of Commerce, at which more than 500 business and civic leaders gathered to toast him.

Having headed the company from a time when it was an unimportant division of the Street Railways Company, Mr. Porter was known and loved by hundreds of employees who, in the earlier days, came in daily contact with him.

Through his more than twenty years as President of the Company, his friendliness and his quality of "Humanness" endeared him to office boys and executives alike.

Two sons of Mr. Porter are now actively engaged in the management of the company, Joseph F. Porter, Jr., Vice-President in Charge of Sales; and Clyde F. Porter, Manager of the Company's East District.

Walter S. Wyman

WALTER SCOTT WYMAN, president of New England Public Service Company and other utilities in the northeastern states, died Nov. 15 of a heart attack at Augusta, Me., at the age of 68. At the time of his death he was in the midst of negotiations for the merger of the Central Maine Power Company and the Cumberland Power and Light Company into a $113,000,000 corporation, of which he was to be president. He was president of both the merging companies. The merger, under which the new company would serve the 14 counties of Lower and Central Maine, recently was approved by the Federal Securities and Exchange Commission and the directors of both companies. It awaited stockholders' action in meetings Nov. 18 at Augusta and Portland.

Born at Oakland, Me., May 6, 1876, a son of Hiram and Ellen Frissell Wyman, Mr. Wyman received his early education at the Coburn Classical Institute in Waterville, Me., and then spent three years, 1893-96, at Tufts College.

He was superintendent of the Maine Water Company, 1896-99; general manager of the Waterville, Fairfield and Oakland Railway, 1899-1901. In 1901 he established the Messalonskee Electric Company, which in 1910 became the Central Maine Power Company, with himself as treasurer and general manager. He had been president since 1924.

During the First World War he developed a power site at Rice Rips, near Oakland, when Maine industries needed greater power to handle war business. Among the companies to come under his control were the Waterville and Fairfield Company, the Union Gas and Electric, the Associated Electric Light and Power, the Kennebec Light and Power, the Skowhegan Electric Light and the Bingham, Clinton, Androscoggin and Knox Electric Companies, as well as the street railway companies of Rockland, Thomaston and Camden.

War Safety

(*Continued from page* 401)

gress and the Administration and the people will rise above their weaknesses and take hold of this problem before it is too late.

Hold on to your skilled first line supervisors as you would your right arm. They are more than a right arm—they are both arms. Of course, you must not neglect to start training any promising prospect for supervisory duties.

Make your supervisors *feel* and *appreciate* their responsibilities for accident prevention, job efficiency and employee morale. They can't do this until you give *them* a careful training and a high morale.

In the above suggestions there is not one mention of a mushroomed chisel, or a cracked ladder rail, or a pair of goggles. Accident prevention programs have got beyond the point where we need to attend national conventions to learn of such things. If I have any single thought to leave with you, it is this:

Accident Prevention Programs will be successful only when the workmen and their supervisors are thoroughly imbued with the determination to do every job as well as they know how to do it, because *every man knows how to do a better job than he actually puts out.* That applies to you and me also.

This determination to do a better job is subject to a multitude of distractions to a man's attention, his loyalty and his perseverance. It is your job as representatives of management to inspire that determination and remove those distractions. Get started now because yesterday was when the job should have been done.

Accident Prevention Committee Meeting

George S. Diehl, *Chairman*

THE fall meeting of the Accident Prevention Committee and the twenty-first meeting of the committee, was held at the Sherman Hotel in Chicago on Oct. 30 and 31, immediately following the Thirty-first National Safety Congress and Exposition of the National Safety Council.

On the first day the committee gave particular attention to those activities for the coming year which are related directly with the committee's interest in the war effort. This included a discussion of the work being done by the National Committee for the Conservation of Manpower in War Industries which had been on the program at one of the sessions of the National Safety Congress. While the activities of this National Committee embrace phases of training work in addition to safety, the safety aspects were emphasized in the discussion held during the Accident Prevention Committee meeting. It was brought out that one of the purposes of this committee is to assist in the teaching of accident prevention and safety in those plants or companies which have been awarded war contracts. The United States has been divided into eight regions with a regional representative in charge of each region. Each region has an advisory committee and also each state is served by an advisory committee. The field work, which consists of making contacts with and rendering safety service to various employers, is performed by special representatives. One of the main activities is the supervising of industrial safety engineering courses which are conducted by state engineering colleges or universities. Each course consists of 96 hours of classroom work, usually held after working hours, and it is reported that more than 20,000 students have enrolled.

There was considerable discussion of accidents that occur to linemen due to climber gaffs "cutting-out" while at work on the pole. It was brought out that this is one of the causes of numerous accidents to linemen, although the number of serious accidents, as compared with the number of times that the climbers "cut-out," is relatively small. It was decided to undertake a study within the committee on this problem, working with the manufacturers of climbers and with line crew foremen who are in many cases closely associated with the repair and maintenance of climbers. It is expected that a report on this will be made at the next meeting of the committee.

A summary was discussed that had been prepared as an individual company activity concerning the selection, care and use of live line tools. This had been given to the committee as information and showed the practice of something over 20 companies.

Mr. T. R. Claffy contributed an interesting account of the present situation with regard to the use of rubber for linemen's protective equipment, which was a continuation of a similar discussion he gave at the Twentieth meeting of the committee (Chicago, May 5 and 6, 1942). Mr. Claffy mentioned the effect on the rubber supply for linemen's protective equipment of the report of the Baruch Committee which had been appointed to investigate the entire rubber situation. He left no doubt as to the critical situation that exists and emphasized the necessity for present stocks of rubber being conserved by every means possible. He also discussed the possibilities of using synthetic rubber and reclaimed rubber in so far as these may concern the manufacture of linemen's rubber protective equipment and pointed out that since the first of last September, the consumption of rubber has been controlled by the War Production Board Order No. M-15-b which lists the products that are permissible and those that are prohibited. A separate order, No. M-15-b-1, limits the amount of rubber that may be used in making certain products on the permitted list.

Mr. Claffy stated that the authorities have continued to recognize the importance of linemen's rubber protective devices and have allowed gloves, line hose, insulator hoods, blankets, sleeves, cable end test caps and insulating stools to remain on the highest permitted list which sanctions the use of fresh crude rubber and without changing peacetime specifications. All concerned were urged to take immediate steps to prolong the life of protective equipment on hand at the present time and recommended the careful study of the methods for repairing punctures as well as protecting the goods from damage which were described in articles appearing in the May issue of the *National Safety News* and the July issue of the EDISON ELECTRIC INSTITUTE BULLETIN.

An interesting summary was presented of a study that had been made of 1941 electrical accidents involving 550 volts or less. This summary was based on an extensive and fairly complete set of newspaper clippings and showed that, of 264 accidents involving 550 volts or less, 55 per cent occurred during June, July and August and 72 per cent occurred from May to September inclusive. It also showed that approximately 59 per cent of the total number of accidents were in industrial establishments, 39 per cent in the home and 2 per cent were among utility employees.

In a discussion on pole-top resuscitation it was brought out that several industries in addition to the electric utilities are interested in this method of resuscitation from electric shock. These include pipeline companies, oil refineries and others who may have occasion to employ linemen whose work might result in their receiving an electric shock while at work. Mr. W. R. Smith reported on this subject and presented for consideration a technique that had been prepared for the use of those who might be interested in teaching this method of resuscitation to employees.

A report was presented on the accident statistics that had been collected for the electric light and power industry for 1941. This report covered approximately 270,000 employees, involving an exposure of approximately 542,000,000 man-hours. These data included approximately 6500 disabling injuries, of which 140 were fatalities and permanent total disabilities, 180 permanent partial disabilities and 6150 temporary total disabilities.

There was extensive discussion of classification of employee accidents. Efforts have been made by several companies to classify their accidents in accordance with American Standards Association Recommended Practice, Z16.2-1941. Experience shows that, whereas a

classification can be applied with fair success within an individual company, the personal element involved in interpreting the code by different individuals makes it difficult to combine the classifications of different companies to obtain results that can be considered as representative for the industry. It was pointed out that this committee desires to make a continued earnest effort in this direction but may, based on further experience, need to modify the ASA standard to some extent to make it suitable for an industry classification code. This is being given careful study and every effort will be made consistent with the time available, to classify the employee accidents of the industry in order that representative data may be obtained upon which to base future safety and accident prevention efforts.

A report was submitted on the preparation of a Certificate of Merit Award which had been authorized for issuing to companies or divisions of companies that complete 1,000,000 man-hours of work without a disabling injury. It was brought out that a department of one company has already qualified for this award and as soon as a few remaining details can be worked out concerning the certificate, these awards will be available.

A review was made by the committee of the committee's forthcoming "Suggestions for Air Raid Wardens Relating to Emergency Conditions in Streets Affecting Electric Service Facilities." The suggestions that had been prepared by a subcommittee were considered and approved subject to editorial changes. It is expected that these suggestions will be completed in the near future.

A number of other subjects were brought up for brief and general consideration but unless they bore some direct relation to safety and accident prevention as this is concerned with war work activities, they were deferred until more time is available for their study and consideration.

In a discussion with reference to holding a winter meeting of the committee it was the consensus of those present that the committee should not discontinue any of its regular meetings but should convene at least as frequently as it has been in the past, in order that the new problems arising in war activities, may be given prompt and effective consideration. The winter meeting of the committee will be held during the early part of February in Pittsburgh.

CORRESPONDENCE

The Neil Historical Article on the Industry

REPRINTS of the historical article "Entering the Seventh Decade of Electric Power" by Charles E. Neil in the September issue of the BULLETIN have been ordered by a number of companies for distribution to employees.

Typical of comments on the article is the following excerpt from a letter from Mr. R. D. Cutler, vice-president of The Hartford Electric Light Company.

"Before I had a chance to read it, Mr. Ferguson called my attention to the leading article in the September issue of the EEI BULLETIN, 'Entering the Seventh Decade of Electric Power,' by Charles E. Neil, North American Company. He is so enthusiastic about this article that he has asked me if you could arrange for us to secure 2500 reprints. His purpose is to distribute this article to every employee, both those presently employed and all new employees.

"I agreed with him that this is one of the most interesting and informative reviews of the electrical industry to date. In addition, it is delightfully written.

"It occurs to me that it would be well in arranging these reprints to include page 333, which is the unpublished letter of the late Alexander Dow to Mr. Neil. Mr. Dow's reminiscences and comments are always delightful reading."

Mr. Edwin Vennard, vice-president, Middle West Service Company in ordering reprints wrote:

"One cannot help but feel a certain pride in being associated with an industry so ably described in Mr. Neil's splendid article, 'Entering the Seventh Decade of Electric Power.' Business management played an important part in the building of this industry that has brought so many benefits to the people of America."

Mr. J. H. Foote, The Commonwealth & Southern Corporation, Jackson, Mich., supplies additional data on transmission voltages and transformers. He writes:

"The story in the September issue of the EEI BULLETIN by Mr. Charles E. Neil giving some highlights in the history of electric development is intensely interesting and a valuable record. It is fortunate that we are assembling these historical items before all of the men who engaged in making the history are gone. For incorporation with basic historical data a little more detail with respect to transmission voltages and the transformers supplying these voltages is offered.

"Under the head of 'Commercial Development of the Transformer' it is rightly stated by Mr. Neil that line insulators were a hindrance to increasing the pressures between wires much above 50,000 volts in 1904, although about 75 miles of pole line operating at 70,000 volts was put in operation in Western Michigan in 1906, being supplied by delta connected transformers (of Westinghouse manufacture) and continuing to operate at that voltage (maximum actual voltage between wires 75,000 volts) to the present day. The original insulators were Thomas Catalog 4000, which was a 14-in. diameter, four-part insulator. These were replaced in 1914 with Ohio Brass Drawing 9393 insulators, the more modern version of which is Catalog No. 12552.

"A distinctive feature of the 110,000-volt Michigan line placed in operation with Hewlett suspension insulators in 1908 was that the transformers supplying this line and manufactured by the Westinghouse Electric & Manufacturing Company were designed for and operated with delta connection instead of the wye connection. So far as is known this 40-mile line was not only the first to operate at 100,000 volts or over and with suspension insulators, but also it is believed these transformers, which were contracted for on April 4, 1906, and built in 1907, were the first transformers designed to operate for a normal emf across the transformer of 100,000 volts or higher, the transformer banks being operated with delta connection. They were factory tested at 200,000 volts for one minute. Three of these transformers at Croton Dam are still in regular operation today, although for a number of years the voltage has been cut back to 75,000 volts delta.

"This information indicates that the table giving the year the General Electric Company reported increase in voltage of transformers might well be amplified by including the Westinghouse data which would show that in the year 1906 transformers rated 100,000 volts were ordered.

"The General Electric Company correctly shows in 1911 the 140,000-volt delta connected transformers ordered for an Au Sable electric system in Michigan which were put in operation at the close of that year.

"The transformer voltage picture was somewhat confused during the first decade because most of the histories do not distinguish between the voltages impressed across the transformer and the calculated wye voltages which would ensue should the transformers be connected in wye. I can recall that a good many transformers were purchased with a rating indicating wye connection but which were operated at 57 per cent of that voltage in delta connection. The Croton-Grand Rapids line placed in operation at 110,000 volts with delta connected transformers in the spring of 1908, and the Au Sable River-Flint line placed in operation in the winter of 1911-1912 at 140,000 volts with delta connected transformers formed interesting milestones in the art of high voltage transformation and transmission."

7th DECADE REPRINTS

Reprints of the historical article "Entering the Seventh Decade of Electric Power" by Charles E. Neil in the September issue of the EEI BULLETIN include "Early Troubles of the Power Engineer" by the late Alex Dow.

Reprints may be obtained at the following basic rates:

10c each
$6.00 per hundred
38.00 per thousand

EDISON ELECTRIC INSTITUTE
420 Lexington Avenue
New York, N. Y.

RECENT E.E.I. PUBLICATIONS

BOILERS—COMBUSTION 1941

EEI Pub. J-7. A report of the Boilers and Combustion Subcommittee of the Prime Movers Committee, Edison Electric Institute, 80 pages. Price $1.20 to members and their employees; $3.00 to non-members in the U. S. A.; $3.15 to foreign countries.

THE make-up of the Boilers and Combustion Report for 1941 follows, in general, the form adopted for the 1940 report.

The activities of the Subcommittee have been extended to include the collection of boiler-outage data for 300 steam generators over 200,000-lb per hr capacity. These data, similar to the information on turbines collected by the Turbine Subcommittee, have been analyzed for 1940 and made available to members of the Prime Movers Committee and other Committees of the Institute. They show the following outage rates for weekdays, excluding Saturdays and holidays:

OUTAGE IN PER CENT OF DAYS EXPOSED*

Below 1000 psi		1000 psi and over	
No. of Units	Rate	No. of Units	Rate
254	1.0%	46	1.6%

* Days exposed are total of days operated and days of forced or emergency outage.

Statements by Manufacturers of equipment covered in the Report continue to be a valuable addition; statements of Boiler Manufacturers comprise Section V, including their answers to specific questions discussed in Operating-Company statements on the same subjects.

Design characteristics of the boilers being supplied by the manufacturers follow, in general, the same designs which were listed in the Report for last year. Considerable emphasis has been placed on designs to eliminate small leaks which have been a source of annoying outage, improvement in circulation, and provisions for better external cleaning.

More extensive welding has been used to eliminate leakage at rolled joints and at header handhole caps. Where these troubles have been recited in company statements on rolled and gasketed joints the workmanship and erection appear to be a contributing factor to the leakage.

The trend in high-pressure steam generation is toward the 800- to 1000-psi range with steam temperatures slightly above 900 F. Of the steam generators being built for pressure of 600 lb and above, approximately 30 per cent will fall in the 600-lb class; 40 per cent in the 900-lb class, and 30 per cent in the 1,400-lb class. Two installations, that at Somerset for 1,800-lb operation and that at Sherman Creek for 1,800-lb, are described by the manufacturer. Another interesting boiler unit described is one being built on the West Coast to provide rapid load pickup in the event of hydro-transmission-line failure.

The Subcommittee has attempted to analyze the performance of twenty recent high-temperature installations. These results are presented in Section IV. It would appear that, in general, the proportioning of gas-passage areas and superheater surface has been correct although, in some instances, major alterations have been required to obtain the proper furnace stabilization necessary for superheat control. The most important feature for satisfactory control is the ability to maintain dirt- and slag-free surface.

Unsatisfactory cleaning and excessive replacement of air-heater elements remain a problem in a number of installations. In plants operating with low-sulphur fuels or with exit-flue-gas temperatures well above the dew point, troubles are minimized. On new boiler contracts, approximately half of the units are being equipped with tubular air heaters while the remainder are being supplied with the regenerative type.

The cleaning of boiler surface, both inside and out, is a problem which continues to be of major importance. The increased difficulty of inspecting and cleaning the inside of long and bent boiler tubes, many of which terminate in headers or small drums, requires constant attention to all phases of boiler-water conditioning. One company states that acid cleaning is the only satisfactory method of cleaning such tubes.

The problem of slag elimination is still unsolved. Changes in operating procedure, the addition of more and better cleaning equipment, and provision for adequate access to boiler surface, however, have removed to a large extent the frequency of shutdowns for the removal of slag, commonplace with new boiler units several years ago.

There have been no new developments in stokers during the past year. The efforts of manufacturers have been directed toward perfection of their equipment for the smaller boiler units common in industrial plants.

ICE AND WIND LOADING TABLES FOR OVERHEAD LINE CONDUCTORS

EEI Pub. J-5, 15 pages. Prepared by the Transmission and Distribution Committee, EEI. Single copies, $0.10 per copy; 5-49 copies, $0.06 per copy; 50-99 copies, $0.05 per copy; more than 100 copies, $0.04 per copy.

THESE tables give the vertical, transverse and conductor loading values per linear foot for various kinds of overhead line conductors when used in the light, medium and heavy loading areas as defined in Part 2 of the National Electrical Safety Code, Fifth Edition. The vertical, transverse and conductor loading values have been computed in accordance with Rule 251 and will permit the continued use of existing sag and tension charts based on tension limits that comply with those specified in Rule 261F of the revised code.

These tables are intended as a revision of Tables 83 to 96 inclusive, of the Overhead Systems Reference Book (no longer available), NELA Publication No. 267-5. The revision has been made to include several types of overhead line conductors that have been developed since the Overhead Systems Reference Book was published.

In addition to the loading data, these tables also contain the over-all diameter, the cross sectional area and ultimate strength for each of the conductors listed, and a reproduction of the loading map which shows the territorial division of the United States with respect to the loading of overhead lines, which is contained in the Fifth Edition of the NESC.

SPECIFICATIONS FOR SINGLE TUBE SEAMLESS COPPER SPLICING SLEEVES

EEI Pub. TD-9, 6 pages. A report of the Transmission and Distribution Committee. Price 10c per copy.

THIS report gives the specifications that have been prepared by the Line Hardware Subcommittee of the Transmission and Distribution Committee of the Edison Electric Institute, and supersedes D-950-28T and D-950-31T, which were prepared by the Overhead Systems Committee of the former National Electric Light Association.

EEI PUBLICATIONS

A catalog of all EEI publications is available upon request to

EDISON ELECTRIC INSTITUTE
420 Lexington Avenue, New York

PERSONALS

THOMAS N. MCCARTER, chairman of the board of Public Service Corporation of New Jersey and subsidiary companies and a past president of the Edison Electric Institute, reached the age of 75 on Oct. 20.

Mr. McCarter presided at the monthly meeting of the corporation board of directors in the morning and at 12:30 attended a luncheon in his honor at the Essex House, Newark, at which 400 Public Service employees were present.

Speakers at the luncheon, President Edmund W. Wakelee and Chairman of the Executive Committee Percy S. Young, took occasion to extend birthday congratulations to Mr. McCarter. They cited his fine record of almost 40 years at the helm of the Public Service organization, as president for 36 years and in his present post as chairman of the board for nearly four years.

Mr. McCarter and others organized Public Service Corporation of New Jersey in 1903, combining and rehabilitating various gas, street railway and electric properties which had been doing business in the state. Mr. McCarter was the corporation's first president and he is the only member of the present board of directors who was a member of the corporation's first board.

Present at the luncheon were officials from the general office of Public Service and department heads from all of the company's divisions. The custom of other years has been to hold a luncheon in each division at the conclusion of the inspection of company properties, but because of the urgency of conserving rubber, gasoline and other materials in cooperation with the war effort, it was decided to hold but one luncheon this year. It was thought advisable to hold this on Oct. 20 in recognition of Mr. McCarter's birthday.

EDWARD REYNOLDS, president of the Columbia Gas and Electric Corporation and chairman of the board of Columbia Engineering Corporation, has been appointed special assistant to the Surgeon General of the Army, Major General James C. Magee.

Mr. Reynolds will direct the nonprofessional functions of the Surgeon General's office, his duties primarily relating to the procurement of medical supplies.

Mr. Reynolds was graduated from Harvard University in 1915 and served as an officer in the Navy in the World War.

JOHN W. PERRY of West Point, Va., has been named vice-president and general manager of the Central Ohio Light and Power Company, Findlay, to succeed FRANK C. LANDERS, who is retiring after more than 38 years in the electric public utility business. The change will become effective Dec. 1, Floyd W. Woodcock, president of the company, announced.

Mr. Perry was treasurer of the Central Ohio Company for eight years from 1931 to 1939 and for the past three years has been vice-president and general manager of the Virginia East Coast Utilities Inc., Richmond.

Mr. Landers has been associated with companies under Mr. Woodcock's management for the past 22 years. His experience includes operation of electric utility companies in New York, Maryland, Florida, Georgia, Texas, Louisiana and Ohio.

Mr. Perry is being succeeded by JAMES G. MCCLELLAN, who was general manager of Louisiana Ice and Electric Co. Inc.

OTTO A. KNOPP has retired as chief of Pacific Gas and Electric Co.'s bureau of tests and inspections at Emeryville, Calif., following almost 40 years' service with that company. He is succeeded by W. N. LINDBLAD. Mr. Knopp wrote numerous articles and made several developments in meters and measurements during his years with the utility.

EDGAR N. PATTERSON, superintendent of operations in the central division of the distribution department of the Duquesne Light Company, has retired after more than 49 years of continuous service. Mr. Patterson started in the public utility industry at the age of 16 with the Chartiers Valley Light and Power Co. in Carnegie, Pa., doing power station work. The following year he joined the old Southern Light, Heat and Power Co., one of the predecessor companies of Duquesne Light, which was organized in 1903. In 1911 he was made district superintendent of the Rankin district and in 1929 when the distribution department was reorganized, he was appointed superintendent of operations in the central division, the position he held until his retirement.

TOM W. CROCKETT has been elected a vice-president of Mississippi Power and Light Company, Jackson, Miss. Mr. Crockett, who is division manager of the central division, will continue to serve in that capacity in addition to his new responsibilities as a vice-president.

RUSSELL C. CRAVENS, statistical engineering department, Kansas City Power and Light Co., Kansas City, Mo., has been made head of a new department organized to coordinate the engineering, operating and accounting requirements of property records. A nucleus for the work of the new department will come from work already done or now in progress by the statistical engineering department.

R. F. HARTENSTEIN, for many years connected with the Ohio Edison Company, as director of lighting, has been given a leave of absence to join the OCD in the capacity of chief of technical section for the Fifth Service Command Protective Branch. His territory will cover four states—Ohio, Indiana, West Virginia and Kentucky. Mr. Hartenstein will serve in an advisory capacity on blackouts, camouflage and protective construction for these four states.

J. P. CONNOLLY, sales manager of the South Carolina Power Co., Charleston, has been appointed manager of customer relations, a newly created department of the company. Mr. Connolly's responsibilities are in addition to his present duties as sales manager.

H. B. LACY, for the past 13 years chief clerk of the Arkansas Power and Light Co.'s northeastern division, has been made assistant to operations manager H. F. Minnis in the company's general offices at Pine Bluff, succeeding J. R. Pierce, who has left Arkansas Power and Light Co. to become vice-president and general manager of the new Arkansas Municipal Water Co., which plans to purchase the power company's water systems in 20 towns.

E.E.I. PUBLICATIONS AND SERVICE MATERIAL

(Prices include transportation in U. S. only. Please order by number shown before title. Standing Orders may be placed for a specified number of copies of reports of various committees as issued, to be shipped to one address.)

Payable in United States Currency—Postage Stamps Not Acceptable

Accounting and Statistical

	Members	Non Members
Accounting		
Digest of Authoritative Opinions of the Definition of Original Cost (Including Appendix on "Prudent Investment") 1938	$1.50	$1.50
Proceedings 1942 Meeting of Gas and Electric Accountants	1.00	1.00
Proceedings—National Accounting Conferences		
Complete Set—6th Conference 1942	1.00	1.00
" " 5th " 1941	2.00	2.00
" " 4th " 1940	2.00	2.00
" " 3rd " 1939	2.00	2.00
" " 2nd " 1938	1.50	1.50
by Groups Yearly—		
Classification of Accounts	.50	.50
Customer's Relation	.50	.50
Depreciation	.50	.50
Plant Accounting and Records	.50	.50
Purchasing Stores & Transportation	.50	.50
General Sessions	.50	.50
Summary of Definitions Covering Depreciation and Related Terms 1939	1.00	1.00
Statistical		
J-2—Electric Light and Power Industry in 1941 (5/42)	.30	.75
I-2—Electric Light and Power Industry in 1940 (5/41)	.30	.75
(Statistical Bulletins also available for years 1932 to 1939 inclusive) each.	.30	.75
Weekly, Monthly and Annual Statistics (Includes Annual Statistical Bulletin; Weekly Electric Power output; Monthly Electrical Research Statistics).	2.00	2.00

Engineering Committees

ACCIDENT PREVENTION—RESUSCITATION

F-10—Tree Trimming Practices (10/38)	.20	.50
E-12—Resuscitation Booklets (7/37)	1— 9 copies .10 each	
	10— 99 " .08 "	
	100—499 " .06 "	
D-18—Your Unseen Helper (1936)	1,000 $10.	
	5,000 30.	
	10,000 50.	
C-14—Resuscitation Charts (4/36)	.10	.10
C-12—Twelve Messages on Accident Prevention in the Electric Public Utilities (12/35)	.10	.10

ELECTRICAL EQUIPMENT COMMITTEE

F-13—Reconditioning Flood Damaged Electrical Equipment (12/38)	.30	.75
F-5—Design of Switchhouses for Generating Stations and Transmission Substations (6/38)	.40	1.00
E-1—Rectifier Wave Shape (4/37)	.40	1.00
C-10—Symbols for Metering Diagrams (12/35)	.10	.10
B-10—Electrical Energy Diversion (10/34)	.20	.50

HYDRAULIC POWER COMMITTEE

D-15—Penstocks (12/35)	1.00	2.50
A-19—Hydraulic Governors (8/33)	.20	.50

JOINT REPORTS

J-8—Utilization Voltage Standardization Recommendations (10/42)	.20	.50
J-6—Wave Shape of Multi-Phase Rectifiers—Engr. Report No. 49—Joint Subcommittee on Development and Research (8/42)	.50	1.25
J-4—Low Frequency Shielding in Telephone Cables—Engineering Report No. 48—Joint Subcommittee on Development and Research (5/42)	.80	2.00
J-1—Positive Disconnection of Distribution Circuits During Faults to Ground—Engineering Report No. 47—Joint Subcommittee on Development and Research (4/42)	.60	1.50
I-9—Standards for Distribution Transformers (Second Report) EEI-NEMA (12/41)	.25	.60
I-8—Susceptiveness of Subscriber Station Sets—Engineering Report No. 46—Joint Subcommittee on Development and Research (12/41)	$0.60	$1.50
I-7—Frequency Weighting for Message Circuit Noise—Engineering Report No. 45—Joint Subcommittee on Development and Research (12/41)	.20	.50
H-12—Neutralizing Transformers—Engineering Report No. 44—Joint Subcommittee on Development and Research (7/41)	.30	.75
H-10—Effects of Bonding Exchange Aerial Telephone Cable Sheaths to Multi-Grounded Power Neutrals—Engineering Report No. 43—Joint Subcommittee on Development and Research (6/41)	.30	.75
H-8—Standard Basic Impulse Insulation Levels — AIEE - EEI - NEMA (1/41)	.05	.05
H-3—Inductive Coordination Aspects of Petersen Coil Grounding—Engr. Report No. 42—Joint Subcommittee on Development and Research (12/40)	.25	.65
H-1—Test Specifications for Household Electric Ranges—EEI-NEMA (5/40)	.20	.50
G-9—Methods of Measuring Radio Noise—EEI-NEMA-RMA (2/40)	.20	.50
F-17—Short-Circuiting Relay Protectors—Engr. Report No. 41—Joint Subcommittee on Development and Research (8/38)	.40	1.00
F-8—Test Specifications, Automatic Electric Storage Water Heaters—EEI-NEMA (10/38)	.20	.50
F-2—Inductive Coordination of Rural Power and Telephone Systems—Engr. Report No. 40—Joint Subcommittee on Development and Research (1/38)	.80	2.00
E-9—Characteristics of Power System Faults to Ground-Engr. Report No. 39—Joint Subcommittee on Development and Research (11/37)	.60	1.50
E-5—Principles and Practices for Inductive Coordination, EEI-AAR (1/37)	no charge	no charge
E-4—Joint Use of Poles 6.6 and 13.2 kv. Safety Features—EEI-Bell Tel. (1/37)	.30	.75
E-3—Jointly Used Wood Pole Lines Specifications—EEI-Bell Tel. (1/37)	.50	1.50
Power Level and Sensitivity of Telephone Circuits—Engr. Report No. 38—Joint Subcommittee on Development and Research (1936)	.40	1.00
Computation of Zero-Sequence Impedance of Power Lines and Cables—Engr. Report No. 37—Joint Subcommittee on Development and Research (1936)	.80	2.00
Selected Devices for Reducing Harmonics in Power Systems—Part II—A-C Systems—Engr. Report No. 34—Joint Subcommittee on Development and Research (1936)	.80	2.00
D-14—Vol. IV—Engineering Reports of the Joint Subcommittee on Development and Research (1/37)	5.00	10.00
D-13—Vol. III—Engineering Reports of the Joint Subcommittee on Development and Research (1/37)	5.00	10.00

PRIME MOVERS COMMITTEE

J-7—Boilers and Combustion 1941 (10/42)	1.20	3.00
I-6—Metallurgy and Piping, 1940 (12/41)	.70	1.75
I-4—Boiler Auxiliaries, 1940-1941 (10/41)	.80	2.00
H-11—Power Station Chemistry, 1940 (7/41)	.40	1.00
H-9—Turbines, Condensers and Associated Equipment (4/41)	.80	2.00
H-7—Boilers—Combustion, 1940 (3/41)	1.60	4.00
G-10—Boilers, Superheaters, Economizers, Air Heaters & Piping, 1939 (4/40)	.80	2.00
G-7—Turbines, Condensers and Pumps (1/40)	.70	1.75
G-3—Combustion, 1939 (12/39)	.80	2.00
F-15—Boilers, Superheaters, Economizers, Air Heaters and Piping, 1938 (12/38)	$1.00	$2.50
F-14—Turbines, Condensers and Pumps, 1938 (12/38)	.70	1.75
F-12—Combustion, 1938 (11/38)	1.00	2.50
E-16—Boilers, Superheaters, Economizers, Air Heaters and Piping, 1937 (12/37)	.90	2.35
E-15—Oil and Gas Engines, 1936-1937 (10/37)	.40	1.00
E-14—Turbines, Condensers and Pumps, 1937 (9/37)	.60	1.50
E-11—Combustion, 1937 (9/37)	.80	2.00
E-10—Power Station Chemistry, 1937 (9/37)	.30	.75
D-11—Turbines, Condensers, Feedwater Heaters and Pumps, 1936 (11/36)	.60	1.50
D-10—Oil and Gas Engines, 1935-1936 (10/36)	.40	1.00
D-8—Superposition of High Pressure Non-Condensing Equipment on Existing Power Stations (10/36)	.25	.65
D-7—Combustion, 1936 (10/36)	.60	1.50
D-6—Boilers, Economizers, Air Heaters and Piping, 1936 (9/36)	.60	1.50
D-5—Power Station Chemistry, 1936 (7/36)	.20	.50
C-8—Oil and Gas Engines, 1934-1935 (10/35)	.50	1.25
C-6—Combustion, 1935 (8/35)	.80	2.00
C-5—Turbines, Condensers and Feedwater heaters, 1935 (7/35)	.40	1.00
C-4—Boilers, Economizers, Air Heaters and Piping, 1935 (7/35)	.60	1.50
B-8—Steam Generation (8/34)	.60	1.50
B-7—Oil and Gas Engines (8/34)	.40	1.00
B-5—Station Piping, 1934 (7/34)	.60	1.50
B-4—Turbines, 1934 (6/34)	.40	1.00
B-3—Condensers, Feedwater Heaters, Evaporators, and Boiler Feed Pumps (6/34)	.45	1.15
A-7—Stoker Equipment and Furnaces (8/33)	.60	1.50
A-6—Pulverized Fuel (8/33)	.75	1.85
A-5—Power Station Chemistry (7/33)	.40	1.00
A-4—Burning of Liquid and Gaseous Fuels (7/33)	.30	.75
A-3—Turbines (8/33)	.75	1.85
A-2—Station Piping (8/33)	.60	1.50

TRANSMISSION AND DISTRIBUTION COMMITTEE

J-5—Ice and Wind Loading Tables for Overhead Line Conductors (Revision of Tables 85 to 96 of the Overhead Systems Reference Book) 1942	1-4 copies 10c	
J-3—Cable Operation 1940 (8/42)	.50	1.25
H-6—Distribution Transformer Load Supervision (3/41)	.60	1.50
H-5—Cable Operation, 1939 (1/41)	.60	1.50
G-5—Cable Operation, 1938 (1/40)	.60	1.50
G-1—A.C. Network Operation, 1936-1937 (8/39)	.80	2.00
F-16—Cable Operation, 1937 (12/38)	.60	1.50
F-10—Tree Trimming Practices (10/38)	.20	.50
F-9—Conductor Sags and Tension for Rural Lines (10/38)	.40	1.00
F-7—Economical Distribution Transformers Loading and Thermal Performance of Distribution Transformers (8/38)	.40	1.00
F-6—Lightning Proof Transmission Lines (7/38)	.60	1.50
F-3—Distribution Transformer Load Characteristics (4/38)	1.00	2.50
F-1—Treatment and Inspection of Creosoted Pine Poles (2/38)	.30	.75
E-17—Cable Operation, 1936 (12/37	.60	1.50
E-8—A.C. Network Operation, 1934-1935 (6/37)	.70	1.60
D-17—Cable Operation, 1935 (12/36)	.60	1.50
D-9—Principles and Practices in Grounding (10/36)	.40	1.00

SUGGESTIONS FOR SPECIFICATIONS

10 to 49 copies 25% discount
50 or more copies 50% discount

MS-1—Suggestions for Specifications for Standard Dial Constants for Alternating Current Watthour Meters (8/40)	.10	.10
MS-2—Suggestions for Specifications for Coordinated and Standardized Low Voltage Metering Current Transformers (8/40)	.10	.10
MS-3—Specifications for Standard Current Transformers for Primary Circuits (8/42)	.10	.10
MS-4—Specifications for Indicating and Cumulative Demand Register Scales (8/42)	.10	.10
TD-1—Suggestions for Specifications for Bolts and Nuts (5/37)	.20	.20

	Members	Non Members
TD-2—Suggestions for Specifications for Strand Eye Anchor Rods (5/42)	$0.10	$0.10
TD-3—Suggestions for Specifications for Lag Screws (10/38)	.10	.10
TD-4—Suggestions for Specifications for Eye Bolts (6/39)	.10	.10
TD-5—Suggestions for Specifications for Eyenuts and Eyelets (4/41)	.10	.10
TD-6—Suggestions for Specifications for Steel Crossarm Braces (5/40)	.10	.10
TD-8—Suggestions for Specifications for Straight Tinned Copper Connectors (10/40)	.10	.10
TD-9—Specifications for Single Tube Seamless Copper Splicing Sleeves (10/42)	.10	.10
TD-10—Suggestions for Specifications for Rolled Steel Washers (5/40)	10.	.10
TD-51—Suggestions for Specifications for Low and Medium Voltage Pin-Type Insulators (5/37)	.10	.10
TD-61—Suggestions for Specifications for Type "A" Untreated Douglas Fir Crossarms (11/40)	.10	.10
TD-62—Suggestions for Specifications for Type "B" Untreated Douglas Fir Crossarms (11/40)	.10	.10
TD-71—Suggestions for Specifications for Insulator and Pin Threads and Gauges (5/37)	.10	.10

General Commercial Committees

Air Conditioning		
Air Conditioning Installations, 1942 (Summary)	$0.50	$0.50
Air Conditioning Installations, 1941	1.00	1.00
Air Conditioning Installations, 1940	1.00	1.00
Lighting		
Typical Promotional Programs — Home Lighting Equipment (1941)	.35	.35
Power		
G-4—Electric Metal-Melting Furnaces (1/40)	.80	2.00
F-11—Electrification of Oil Refineries (10/38)	.30	.75
C-13 Steam and Electrical Requirements of Hotels (12/35)	.30	(members only)
C-2 Steam and Electrical Requirements of Office Building (4/35)	.30	.75
Power Sales Manual (1941)	3.50	5.00
Water Heating		
I-5 Standardization of Electric Water Heating Equipment (10/41)	.20	.50
General		
Utility Appliance Maintenance and Repair Programs	.25	.50
Adjusting Home Service Activities to War Time Conditions	.25	.50

National Educational Programs

Commercial Cooking		
Commercial Cooking Survey, 1942	$ .25	.25
Sales Training Manual—Commercial Electric Cooking, 1941	1-4 copies	$1.50
	5-14 "	1.25
	15 or more	1.00
Domestic Cooking		
Meals Go Modern Electrically	.10	.10
Electric Kitchens		
It Can Happen In Your Kitchen	$2.80 per 100	
How to Plan a Modern All-Electric Kitchen	$2.00 per 100	
The Principles of Kitchen Planning	.25	.25
Films		
"It Happened In The Kitchen"—16 mm. full color, talking motion picture. Including complete promotional program	$212 plus excise tax	
"Dealer Education"—Series of 10 films and 10 discussion manuals. Five on basic selling and five on product selling, i.e., refrigerators, ranges, roasters, water heaters and laundry equipment. Price on meter basis for entire series	$125 to $275	
Lighting Booklets		
Better Light—Better Sight— Better Production	$2.50C	$2.50C
Better Light—Better Sight— Better Living	2.50C	2.50C
Priceless Eyes	2.50C	2.50C
Facts You Should Know About Your Eyesight	$2.00 per 100	

		Members	Non Members
Lighting Films			
"Time to Relight"—(Commercial) sound slide 15 minutes, 85 pictures		$10.00	film & disc
"Light Up—Step Up"—(Industrial) sound slide 15 minutes, 75 pictures		$10.00	film & disc
"You Can Do Something About It"—(Home) sound slide, 15 minutes, 95 pictures		10.00	" " "
Wiring			
Rewiring for Commercial and Industrial Buildings		$0.25	$0.25
Handbook of Interior Wiring Design—1937		.50	.50
Basic Factors of Adequate Wiring —1939		.25	.25
Covered Neutral Cable Helps Sell Adequate Home Wiring—1939		.25	.25
Commercial Building Re-wiring Market—1939		.35	.35
	(Price on above three books as a group is 60c per set)		
Films			
Commercial Re-Wiring — lantern slides		Set	$17.50
Home Wiring—lantern slides		Set	25.00

Miscellaneous, Reference Books, Etc.

Code for Electricity Meters (1941)		$1.60	$2.00
Electrical Metermen's Handbook (1940)		2.40	3.60
Good Radio Reception (1937)	100 copies		4.00
	1000 "		25.00
	3000 "		60.00
	5000 "		95.00
Objective Type Rates, 1933-1936		.80	2.00
Ice and Wind Loading Tables for Overhead Line Conductors (Revision of Tables 85 to 96 of the Overhead Systems Reference Book) 1942	1-4 copies		10c.
	5-49 "		6c.
Power Sales Manual (1941)		3.50	5.00
Rate Book for 1942		10.00	25.00
Rewiring for Commercial and Industrial Buildings (1941)		.25	.25
Sales Training Manual—Commercial Electric Cooking (1941)		$1.50	$1.50
Storm Loading and Strength of Wood Pole Lines and a Study of Wind Gusts (1936)		2.00	5.00

Periodicals

Better Light—Better Sight News (9 issues yearly)	$0.75	$0.75
Edison Electric Institute Bulletin (Monthly)	2.00	2.00
Rural Electrification Exchange (Quarterly)	.60	1.00

Shortage in Manpower

(*Continued from page* 414)

While we have had no special plan for bringing new men into this field, we have stimulated service dealers, through our service dealer development program, to add personnel where it was in the dealer's interest and suitable people were available.

The second phase of the manpower problem, and the one that has perhaps gotten the least attention, is that of increasing the amount of useful work per service man. This, in turn, calls for a program of customer education and of dealer development. It includes such elements as getting customers to take service jobs to the dealer's shop where work can be done more quickly and without lost travel time; getting dealers to schedule their calls to eliminate dead travel time; selling customers on the idea of having all their appliances inspected when a service man has to come to the home, thus reducing the number of later calls that have to be made; passing along to the dealers better methods and short cuts to increase their output; selling the service dealer on the importance of carrying properly-rounded stocks of repair parts to make it more certain that a job, once started, can be pushed through to completion; and last, but certainly not least, is better training for appliance service men. We do not yet have what we consider a satisfactory solution to that problem. However, we are at work along several lines.

A. A sprinkling of service men from communities reasonably close are attending night appliance service classes in three vocational schools.

B. We have made a survey of schools in our territory to find out what kind of equipment and other training facilities they have that might be used to help solve this problem. We are just now in process of making our first school contacts in an attempt to have such classes started in our territory.

C. In one area we will shortly have under way a training class which will be handled by our own personnel.

D. We have encouraged and cooperated with wholesalers and manufacturers in conducting service training schools on their products for dealers in our territory.

E. As a result of our leadership, in one county the service dealers in two of our neighboring districts have organized themselves for the purpose of having regular training sessions on the principal appliances, using manufacturer training facilities. All this is being done without regard to brand.

Company 7 — With the trained manpower situation becoming more serious day by day, electrical service dealers are seeking to combat this problem by sending students to the Appliance Repair Training Classes. These Fall classes, which started Sept. 28th, have enrolled over 260 students, both men and women, representing 95 service outlets. Here is ample proof that some dealers are not going to sit idly by until it is too late.

Protection Against Sabotage

(*Continued from page* 412)

much and how far inland such screening must be done. Until such standards have been established, it is necessary to be governed by local regulations, if any. Light sources which can be seen from the ocean must be completely screened, for these are a definite hazard. Floodlighting projectors should not be pointed toward the ocean as it is very difficult to screen them unless they are behind a building. By careful planning and screening, satisfactory protective lighting can be applied to plants in the coastal areas.

Conclusions

Since enemy-controlled saboteurs are thoroughly trained, resourceful men, skilled in the diabolical art of wreckage, we must provide every assistance to the guards which will enable them to prevent these men from interrupting our war production. Our part in this assistance is to provide the proper lighting so that the guards can see any intruder or any danger before the damage is done. Every project must be carefully studied so as to be sure that any probable point of attack is lighted in such a manner that the guards can work with the maximum efficiency.

Lettering on Engineering Drawings

(*Continued from page* 415)

on the guide, thus eliminating the use of guide lines on the drawing.

Character styles may be standard or individualized and are limited only by the imagination of the user. Some styles are shown in Fig. 1.

While this method does not produce the precision letters obtainable from totally mechanical guides, the final result is neat and workmanlike, and after a little practice the lettering speed is comparable to or faster than that obtained free-hand.

Another method is the use of the typewriter. A stenographer or typist may from dictation or the draftsman's longhand notes do complete or partial lettering jobs on drawings. However, a machine which will accommodate large drawings is not only usually high in cost but the visible working area is very limited. In large engineering organizations the acquisition of this type of equipment is easily justified by the volume of lettering performed, but in smaller organizations the cost would probably prohibit its use.

An economical means of obtaining a machine with the desired characteristics can be had by modifying an Underwood Elliott Fisher billing machine, as shown in Fig. 2. The platen was cut into three sections which were resupported from a sub-base by means of spacer feet. Cutting the platen into three sections formed two slots which allow the drawing to pass and be rolled in the space between the platen and the sub-base, as shown in Fig. 2. This arrangement will take any size drawing, both as to length and width, as shown in Fig. 3, and provides a composing area, visible in Fig. 3, of 18 in. vertically by 16 in. horizontally for one setting. The tracing may be slid lengthwise or rolled vertically for other settings.

Pica Gothic type is recommended because of its clear, sharp images and freedom from curlicues and tails. Other smaller or more elaborate types tend to clog up.

Care should be taken in the choice of a ribbon. The ribbon should not require carbon backing to obtain an opaque image. It should be quick-drying to prevent smudging, and be free from bleeding on the surface of the drawing, and leave no ghost marks after erasures are made.

It will be found that complete typing jobs on drawings are uneconomical from a time-saving viewpoint, and that it is more efficient to confine the machine work to titles, voluminous notes, bills of material, etc., leaving minor notes and dimensions to be lettered by the draftsman. Poor free-hand lettering may be corrected by the use of the new slot guide. This combination will result in drawings which have a much better chance of being considered acceptable.

CONVENTIONS AND MEETINGS

NOVEMBER, 1942

2-3	Canadian Electrical Association, Conference of all Committees, Windsor Hotel, Montreal, Can.
9	Industrial Power and Heating Committee, EEI Headquarters, New York, N. Y.
10	Interstate Power Club, Hotel Martinique, New York, N. Y.
10-12	National Association of Railroad and Utilities Commissioners, Coronado Hotel, St. Louis, Mo.
12	Petroleum Electric Power Association, Baker Hotel, Dallas, Texas.
30	Prime Movers Committee, EEI, Hotel Astor, New York, N. Y.

DECEMBER, 1942

1	Prime Movers Committee, EEI, Hotel Astor, New York, N. Y.
3	Rate Research Committee, EEI, New York, N. Y.
1-4	American Society of Mechanical Engineers, Hotel Astor, New York, N. Y.
12	The Technical Valuation Society, Inc., Annual Forum, New York, N. Y.

JANUARY, 1943

20-22	American Society of Civil Engineers, New York, N. Y.
25-29	American Institute of Electrical Engineers, New York, N. Y.

American War Standard

Important Revisions to the Code for Electricity Meters

(Paragraph 827)

The following revisions to the Code for Electricity Meters—C12-1941, a approved by the American Standards Association on May 5, 1941, were requested by the National Bureau of Standards, the Association of Edison Illuminating Companies, and the Edison Electric Institute, because of the existing and prospective stringency of men and materials due to the demands of the war effort.

The revisions were prepared by the ASA Committee on the Code for Electricity Meters, acting under the ASA War Procedure as a War Standards Committee, and were subsequently approved as American War Standard Revisions on Nov. 5, 1942. These revisions should be used in connection with the Code, copies of which may be obtained from the ASA office or the Edison Electric Institute.

American War Standard Revisions to the Code for Electricity Meters

827. Schedule. A suggested schedule for periodic tests during the present war period is as follows:

WAR SCHEDULE FOR PERIODIC TESTING OF WATTHOUR METERS

Alternating-Current Meters	
Up to and including 12 kva	at least once in 96 months
Over 12 kva up to and including 100 kva	at least once in 24 months
Over 100 kva	at least once in 12 months
Direct-current Meters	
Up to and including 6 kw	at least once in 42 months
Over 6 kw up to and including 100 kw	at least once in 18 months
Over 100 kw	at least once in 12 months

However, beginning not later than 6 months from the cessation of hostilities, the testing of a-c meters of 6 kva or less shall be resumed at an average rate of 1/6 of the number of such meters on the system per year; the testing of a-c meters of 6 to 12 kva shall be resumed at the rate of ½ of such meters on the system per year.

Note: The kva rating of an alternating-current, single-element meter or the kw rating of a direct-current meter is the product of the rated voltage and the rated current. In the case of polyphase or multi-element meters the rating is the sum of such products for each element. When meters are connected to and tested in conjunction with instrument transformers or shunts, the nominal rating of the transformers or shunts shall be used in the determination of the kva rating of the metering equipment.

Note: This section may be pasted on page 98 of the Code for Electricity Meters—C12-1941.

OFFICERS AND COMMITTEES OF THE EDISON ELECTRIC INSTITUTE

1942-1943

OFFICERS

C. W. KELLOGG, *President*
420 Lexington Avenue, New York, N. Y.

PAUL M. DOWNING, *Vice-President*
Pacific Gas & Electric Co., San Francisco, Cal.

H. S. BENNION, *Vice-President & Managing Director*
420 Lexington Avenue, New York, N. Y.

W. E. MITCHELL, *Vice-President*
Georgia Power Co., Atlanta, Ga.

J. C. LEIGHTON, *Treasurer*
Engineers Public Service Co., New York, N. Y.

MAE B. WOODS, *Secretary*
420 Lexington Avenue, New York, N. Y.

OPERATING COMMITTEE

Chairman, C. W. KELLOGG, New York, N. Y.

H. C. BLACKWELL, The Cincinnati Gas & Electric Co., Cincinnati, Ohio.

H. B. BRYANS, Philadelphia Electric Co., Philadelphia, Pa.

W. H. BURKE, Ebasco Services Incorporated, New York, N. Y.

C. L. CAMPBELL, The Connecticut Light & Power Co., Hartford, Conn.

GEORGE A. DAVIS, Oklahoma Gas and Electric Co., Oklahoma City, Okla.

PAUL M. DOWNING, Pacific Gas and Electric Co., San Francisco, Calif.

WILLIAM KELLY, Buffalo Niagara & Eastern Power Corp., Buffalo, N. Y.

J. C. LEIGHTON, Engineers Public Service Co., New York, N. Y.

FRANK MCLAUGHLIN, Puget Sound Power & Light Co., Seattle, Wash.

W. E. MITCHELL, Georgia Power Co., Atlanta, Ga.

RALPH MOODY, Union Electric Co. of Missouri, St. Louis, Mo.

JAMES H. POLHEMUS, Portland General Electric Co., Portland, Ore.

W. H. SAMMIS, The Commonwealth & Southern Corp., New York, N. Y.

CHESTER C. SMITH, Kansas City Power & Light Co., Kansas City, Mo.

PHILIP SPORN, American Gas & Electric Service Corp., New York, N. Y.

E. C. STONE, Duquesne Light Co., Pittsburgh, Pa.

L. V. SUTTON, Carolina Power & Light Co., Raleigh, N. C.

R. L. THOMAS, Consolidated Gas Electric Light & Power Co., Baltimore, Md.

E. S. THOMPSON, American Water Works & Electric Co., New York, N. Y.

G. W. VAN DERZEE, Wisconsin Electric Power Co., Milwaukee, Wis.

H. E. YOUNG, Northern States Power Co., Minneapolis, Minn.

P. S. YOUNG, Public Service Electric & Gas Co., Newark, N. J.

CHAIRMEN OF THE COMMITTEES

Accident Prevention, GEORGE S. DIEHL, Pennsylvania Water & Power Co., Baltimore, Md.

Accounting Executive, F. B. FLAHIVE, Columbia Gas & Electric Corp., New York, N. Y.

Customers' Relations, Commercial Accounting and Collections, H. R. FLANEGAN, Philadelphia Electric Co., Philadelphia, Pa.

Depreciation, H. L. GRUEHN, Consolidated Gas Electric Light & Power Co., Baltimore, Md.

Plant Accounting and Records, H. P. TAYLOR, Wisconsin Public Service Corp., Milwaukee, Wisc.

Purchasing Stores and Transportation, W. P. MCARDLE, Ebasco Services Incorporated, New York, N. Y.

Electrical Equipment, R. T. HENRY, Buffalo Niagara & Eastern Power Corp., Buffalo, N. Y.

Hydraulic Power, E. A. LE FEVER, Susquehanna Electric Co., Conowingo, Md.

Insurance, J. H. NICKELL, Philadelphia Electric Co., Philadelphia, Pa.

Membership, EDWARD REYNOLDS, Columbia Gas & Electric Corp., New York, N. Y.

Meter and Service, H. A. HOWERY, Kansas City Power & Light Co., Kansas City, Mo.

Prime Movers, J. A. KEETH, Kansas City Power & Light Co., Kansas City, Mo.

Prize Awards, P. S. YOUNG, Public Service Electric & Gas Co., Newark, N. J.

Rate Research, F. A. NEWTON, The Commonwealth & Southern Corp., New York, N. Y.

General Commercial, EDWIN VENNARD, Middle West Service Co., Chicago, Ill.

Statistical, W. G. BOURNE, JR., The Commonwealth & Southern Corp., New York, N. Y.

Transmission and Distribution, E. V. SAYLES, The Commonwealth & Southern Corp., Jackson, Mich.

Codes and Standards (a Subcommittee of the Operating Committee) H. B. BRYANS, Philadelphia Electric Co., Philadelphia, Pa.

BOARD OF TRUSTEES
OF THE
EDISON ELECTRIC INSTITUTE
1942-1943

(*Terms expiring* 1943)

PHILIP G. GOSSLER.....Columbia Gas & Electric Corporation, New York, N. Y.
H. P. LIVERSIDGE.....Philadelphia Electric Company, Philadelphia, Pa.
WILLIAM MCCLELLAN.....Union Electric Company of Missouri, St. Louis, Mo.
K. M. ROBINSON.....The Washington Water Power Company, Spokane, Wash.
P. L. SMITH.....Middle West Corporation, Chicago, Ill.
GEORGE N. TIDD.....American Gas & Electric Company, New York, N. Y.
JOHN E. ZIMMERMANN.....The United Gas Improvement Company, Philadelphia, Pa.

(*Terms expiring* 1944)

D. C. BARNES.....Engineers Public Service Company, New York, N. Y.
SAMUEL FERGUSON.....The Hartford Electric Light Company, Hartford, Conn.
C. E. GROESBECK.....Electric Bond and Share Company, New York, N. Y.
W. J. HAGENAH.....Public Utility Engineering & Service Corp., Chicago, Ill.
EDWARD REYNOLDS.....Columbia Gas & Electric Corporation, New York, N. Y.
E. W. WAKELEE.....Public Service Corporation of New Jersey, Newark, N. J.

(*Terms expiring* 1945)

JAMES B. BLACK.....Pacific Gas and Electric Company, San Francisco, Cal.
J. E. DAVIDSON.....Nebraska Power Co., Omaha, Neb.
JAMES F. FOGARTY.....The North American Company, New York, N. Y.
C. W. KELLOGG.....Edison Electric Institute, New York, N. Y.
B. W. LYNCH.....San Diego Gas & Electric Co., San Diego, Cal.
A. C. MARSHALL.....The Detroit Edison Company, Detroit, Mich.
A. B. PATERSON.....New Orleans Public Service Inc., New Orleans, La.
H. HOBART PORTER.....American Water Works & Electric Company, Inc., New York, N. Y.
HERBERT A. WAGNER.....Consolidated Gas Electric Light & Power Company of Baltimore, Baltimore, Md.
JUSTIN R. WHITING.....The Commonwealth & Southern Corporation, New York, N. Y.